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THE DEVELOPMENT OF A MULTI-FUNCTION COMPUTER-ASSISTED INSTRUCTION SYSTEM USING A HIERARCHICAL DATABASE STRUCTURE AS THE LESSON COMPENDIUM.

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Submitted for the Degree of Doctor of Philosophy in Computer Science of the University of Aston in Birmingham

June 1982

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INTRODUCTION

The purpose of these Appendices is to supplement wherever appropriate the main text. For clarity of cross-reference the Appendices have been numbered to correspond directly with the relevant chapters of the main text - e.g. Appendices 3.1, 3.2 and 3.3 relate to Chapter 3. In the event of a particular chapter not requiring further appendix information, then the corresponding Appendix number has not been used - e.g. Appendix 2 does not exist.

appendices

APPENDIX 1.1 - Compower Computer Centres and Hardware

LOCATION	MAINFRAME(S)	SYSTEM(S)	COMMENTS
EDINBURGH	ICL 2946	DME/2, GEORGE2	
GATESHEAD	ICL 2955	DME/2, GEORGE2 MINIMAC	
DONCASTER	IBM 370/158	MVS, JES	
	IBM 370/158	MVS, IMS/DC	Dedicated database machine
	ICL 2970	VME/B, MAC	
LOWTON	ICL 2945	DME/2, GEORGE 2, MINIMAC	
CANNOCK	IBM 3033	VM/370, CMS, MVS.	Mostly used for system development
	IBM 3081	MVS, IMS/DC, TSØ, VSPC, JES, STAIRS	Main NCB on-line machine
	PDP 11/70	RSX 11M	'Hub' of scientific network
TREDOMEN	IBM 4341	MVS	Installation due Sept. 1982

APPENDIX 3.1

- SCHOOL Database Logical Record formats.

	SCHOOL DAT	TABASE -	Loc	gical Record	Format
s	EGMENT	CONTROL (ROOT))	Pa	age 1 of 4
R	RECORD	MASTER CONTROL	L RECORD	(MCR)	
No.	I	Field	Size	Format	Comments
1	Record id	entification	1	binary	value X'01'
2	System ver	rsion no.	4	character	format: 9.99
3		: em Control mode or Control mode	. 6 . 6	character character	
4	1	able information block pointer	3	binary	standard DBTU pointer format
	- size		2	binary	no. DBTU's in Table
5	- recor	essage Record block rd pointer ciated expiry date	3	binary (standard pointer format) packed OY YD DD	Repeated 10 times; Contains X'FFFFFF00 0000' if not in use.
6	No. subje	ects on system	1	binary	
7	- name	Information rd pointer	15 3	character binary (standard pointer format)	r)) Repeated) 50 times)
					/Contd

	SCHOOL DAT	'ABASE –	Log	ical Re	cord	For	mat		
s	EGMENT	CONTROL (ROOT)		Pag	je	2	of	4
R	RECORD MASTER CONTRO			(Conti	nued)			
No.	F	ield	Size	Forma	.t		Comn	nents	
8	- return - error - active - System detail (a)	PSW e module name m Manager ls:	1 8 8 20 40	binar " chara chara	cter				
	(c)		25	11					
9	Global Time Switch (a) date (b) time (c) user level		3 3 1	packe ''	ed	1	YD MM		
								/end	

	SCHOOL DAT	rabase –	Loç	SCHOOL DATABASE - Logical Record Format										
S	EGMENT	CONTROL (ROOT) Page 3 of							4					
R	RECORD	GLOBAL MESSAGE	RECORD	(GMR)			الأناف فيستان المراق الم							
No.	I	Field	Size	Forma	ıt		Comm	nents	;					
1	Message no.		1	packe	.d		0 -	9						
2	Ĕxpiry da	te	3	packe	ed.	OY	YD I	DD	_					
3	Expansion		10	binar	y	ze:	ros	·						
	avail	ently unused but lable for further col fields.		,										
4	Message		maximum 1171	Standa Frame Block format	Data (FDB)	Sc:	reen	6 li n era	nes sed					
								/en	d					

	SCHOOL DAT	ABASE -	Log	ical Re	cord	For	nat		
9	SEGMENT	CONTROL (ROOT)			Pag	je	4	of	4
F	RECORD	BIT MAP TABLE (BMT)						
No.	F	'ield	Size	Forma	ıt		Comm	ents	;
1	of binary O - inc CO DB: 1 - inc coi		4000 bytes (current)	binar	у .	(40 cat Dat up DBT	000 l ters tabas to 3	t size ytes for se on 32000	s) f O
								/er	nd

	SCHOOL DAT	'ABASE –	Log	gical Re	cord	For	mat		
S	EGMENT	SUBJECT			Pag	je	1	of	6
R	ECORD	SUBJECT CONTRO	L RECORD	(SCR)					
No.	F	ield	Size	Forma	ı	Comm	ent:	5	
1	Subject n	ame	15	charac	ter _.		-		
2	Subject r	eference no.	1	binary			···-		
3	Date of o	riginal creation	6	charac	ter	DDN	MYY		
4	Subject m infor	anager mation:			:				
	<u> </u>	name location	15 25	charac "	ter				
5	No. lesso defined w subject	ns currently ithin this	1	binary				· · · · · · · · · · · · · · · · · · ·	
6	Lesson Co pointer	ntrol Record 's	3	binary (standa pointe format) repeated) 40 times;) set to X'			FF.	
7		Jessage Record block d pointer y date	3	binary (standa pointe format packed OY YD	ard er t)) 1) s) F) i	epea O ti et t FFFF f no	mes o ? FOO	; X' 0000'
8	Student F	Reference Table pointer	3	binar	у	pc	anda inte	er	
9	avai	n zone ently unused but lable for further rol fields	30	binar	у	ze	eros		
							,	/Con	td

	SCHOOL DAT	'ABASE -	Log	jical Re	cord	Fori	nat		
S	EGMENT	SUBJECT			Pag	je	2	of	6
I	RECORD	SUBJECT CONTROL	RECORD	(Contin	ued	.)			
No.	F	rield	Size	Forma	t	(Comm	ents	
10	Introducto	ory Text	maximum 368	Standa: Frame I Block (FDB) format	Data	scr bef and sta	een ore l mes	line eras disp ssage l on line	sed play e
						SCI	een	/er	

	SCHOOL DAT	'ABASE -	Log	ical Re	cord	For	mat		
S	EGMENT	SUBJECT	Page 3 of						
R	ECORD	SUBJECT MESSAG	E RECORD						
No.	F	Field	Size	Forma	mat Comm				5
1	Message n	0.	1	packed		 ***	0 -	9	
2	Subject r	eference no.	1	binary					
3	Subject p	assword	4	charac	ter				
4	Expiry da	te	· 3	packed		OY	YD	DD	
5	Expansion	zone	10	binary		zeı	os		
	but av	ntly unused vailable for er control fields							
6	Message t	ext	maximum 1171	Standa Frame Block format	Data (FDB)	sc: era	reen	bef	
								/e	nd

	,	SCHOOL DAT	ABASE -	Log	gical Re	cord	For	nat		
	S	EGMENT	SUBJECT			Pag	je	4	of	6
	R	ECORD	STUDENT REFERE	STUDENT REFERENCE TABLE (SRT)						
	No.	F	ield	Forma	Comments					
	1		nts currently to subject	2	packed		0 - 100			
	2	inform	dentification ation block:		,		,			
		- name - loca - iden		15 15 2	charact " binary:) ma	axim 00 t	ted um o imes al n	f .
•		(uni ent	que within ire system)		(byte l subject reference no. by is studid. no	ence te 2 ident) depend) the no 2) studer		es ds o o. nts ntly	n
			ent Performance rd pointer	3	binary (stand DBTU pointe format	lard er)			
		- Acti	ve Flag	1	binary		1	cur	act rent syst	ly.
			• ,						/end	1

	SCHOOL DAT	'ABASE –	Lo	gical Re	cord	For	mat			
S	EGMENT	SUBJECT			Pag	ge	5	of	6	
R	ECORD	STUDENT PERFOR	RMANCE RE	CORD (S	PR)					
No.	F	`ield	Size	Forma	t	Comments				
1	Student io	dentification	2	binary		byte 1: subject reference no. byte 2: student id.no				
2	Subject me	essage status	1	packed		C) -	9		
3	1	art session test session	3) packed YY				Z DD D÷		
4	(i.e. tota	ive duration al time on ject by this dent)	3	packed			in minutes (rounded)			
5	Completio (for la	n code st session)		charac	ter	values: 'N' - normal 'S' - suspending - abando 'R' - repeat 'P' - in progr (when recolleft in this state this normally due to TP systelabend).			nded oned ted ress ord is is ue	
6	Current s	tudent status:								
		rame no.	1	binary	J					
							/	Cont	d	

	SCHOOL DAT	'ABASE –	Log	gical Re	cord	Fon	mat			
S	EGMENT	LESSON			Pag	je	1	of	7	
R	ECORD	LESSON CONTROL	RECORD (LCR)						
No.	F	'ield	Size	Forma	t	Comments				
1	Associate referen	d subject . ce no.	1	binary	7 .					
2	Lesson re	ference no.	1	binary	7		·			
3	·Title		30	charac	cter					
4	Password		4	charac	cter					
5	Author		20	charac	cter					
6	Control r	ecord block:				L	to			
		sson Analysis Record pointer	3)	X'FFFFFF' if not in use					
		ntax Information Block pointer	3	binary (stand	dard					
ŕ	- Glo	ossary Reference Table pointer	3) forma						
7	Passmarks	6								
	- eas	sy scoring mode	2	packe	d					
	- har	ed scoring mode	2	packe	d 	va	lues	S :		
8	Current	scoring mode	1	chara	cter	'E'	- 6 - 1	easy		
9	Hard copy	y flag ·	1	binar	у	}	- se hard	ot seet, d cop l be duced	ру	
					,		/c	ontd	•	
				<u> </u>		<u></u>			-	

	SCHOOL DAT	'ABASE -	Log	gical Re	cord	For	mat			
S	EGMENT	LESSON			Pag	je	2	of	7	
R.	ECORD	LESSON CONTROL	RECORD	(contin	ued)					
No.	F	ield	Size	Forma	Comments					
10	Expansion - curren	zone tly unused	20	binary		zeros				
11	No. frames in lesson		. 1	binary						
13	- ques - Prim Re - Prim Re - Hint Re - Comm	ords block: tion no. ary Question cord pointer ary Answer cord pointer Information cord pointer ent Information cord pointer	1 3 3 3 3 maximum 368	binary))))Binary)(stand) point) forma)) Standar Frame I Block format	/ lard cer at)	max scr bef and sta	imes nuse s se FF. 5 een ore mes rteo	ted Ad ent t to line eras disp sage	ny try .' es; ed lay	
								/er	nd	

	SCHOOL DAT	CABASE -	Log	gical Re	cord	For	mat			
S	EGMENT	LESSON			Pag	ge	3	of	7	
R	ECORD	LESSON ANALYSI	S RECORD							
No.	F	rield	Size	Forma	Comments					
1	Associate refere	d subject nce no.	1	binary						
2	Associate refere	d lesson nce no.	1	binary						
3	Overall i	nformation:								
	- no. t	imes lesson used	3)						
	- no. t	imes completed	3))) packe	ď					
	- no. t	imes SUSPENDed	. 3) packe	·u					
	- no. t	imes ABANDONed	3	}. 						
4		es in lesson g analysed	. 1	binary	7					
5	Total tim student lessor	ne spent by all is on this	4	packed.	i i	in	minu	ites		
6	Frame Ana	alysis block:								
	- fram		1	binary	J					
	1	times used	3	R			eate def			
	- no.	attempts at answer	3			no.	fra	umes		
	- no.	times incorrect	3	K		les	sson.	,		
		times hint requested	3	packed	i	any is	e th / fra miss	ame r	out	
		times answer requested	3			sec	the quenc g.1,	ce		
	- tota	al marks awarded:		b		the	en a alysi	dumr		
	ŀ	easy mode	4	4) entry:			try i	S	1	
	(p)	hard mode	4	 		thi	is ex	kamp:	le	
 								/ei	nd	

	SCHOOL DAT	'ABASE –	Loc	gical Re	cord	For:	mat		
S	EGMENT	LESSON			Pag	je	4	of	7
R'	ECORD	SYNTAX INFORMAT:	ION BLOCK	5					
No.	F	Field	Size	Forma	ιt	Comments			
1	Space flag - leadi - trail - non-s - all	ing	1 1 1 1)))) bina)))))))), al) set	lues leave in de: ll s t, ove l ot	e tact lete pace erid her	' if	
2	Common pur	nctuation flag	1	binar	У) values:			
3	Leading z	eros flag	1	binar	: у	0 - leave intact 1 - delete			ct
4	Redundant	brackets flag	1	binar	: у) 1	- d	elet ——	.e
5	No. charadeleti	cters in on table	1	binar	V	alue 0 -			
6	Deletion	character table	16	chara	.cter				
7	Conversio	on indicator	1	chara	cter	111	- c t u - c	inpu conve co pper conve	it ert case
8	No. entri table	es in substitutio	on 1	binar	rу				
. 9	Substitut	cion table	40 (20x2)	charā	acter	pa fi) 2- dirs; lled	spa lif	acte ace-
10	No. entri table	ies in stop word	1	binar	ry				
				,			/0	Conto	ł

	SCHOOL DATABASE - Logical Record Format									
S	EGMENT	LESSON	Page 5 of 7							
R.	ECORD	SYNTAX INFORMAT	TION BLOC	.))					
No.	F	ield	Size	Forma	Comments					
11	Stop word	S ,	150 character (15x10)			15 10-charact word entries; Space-filled if unused.				
12	Keyword t - Sub-t - Sub-t	able A	. 40 (4x10) 40 (4x10))))charact))) Each sub-)table)consists of)4 10-char.)word entries					
13	Variable - Sub-1 - Sub-1		40 (4x10) 40 (4x10)))) charac)	cter	\sp	ace-	fill in	.ed	
14	Word limi	i t	1	binar	У					
15	Word leng	gth table	12 (12×1)	binar	у	12 1e en	ngth	byt : :s	ce	
								/End		

SCHOOL DATABASE - Logical Record Format									
S	EGMENT	LESSON	Page 6 of 7						
R	ECORD	GLOSSARY REFER	ENCE TABL	E					
No.	F	rield	Size	Forma	Comments			5	
1	Associated refere	d subject . nce no.	1	binar	·				
2	Lesson re	ference no.	1	binar	У				
3	No. gloss	ary entries	1	binar	У		ue: - 4		
4	Glossary Word/phras		1 20	binar charac)	<u> </u>		
	Record)		3	stand DBTU point forma set t X'FFFF if thi a requ but no suppor word	er t; o FF' s is estec t	1 /			f
·	No. times	requested	3	packed		\(\)			
								/End	

	SCHOOL DAT	'ABASE –	Log	gical Re	cord	Fori	mat		
S	EGMENT	LESSON			Pag	je	7	of	7
F	RECORD	GLOSSARY DEI	DEFINITION RECORD						
No.	F	ield'	Size	Forma	t	Comments			
1	Correspon Referer	ding Glossary ace Table entry no.	1	binary	<i>J</i> •				
2	Word/phra	se description	maximum 222	standar Frame I Block (format	Data	3 s	imum cree lenç	n li	nes
								'end	

	SCHOOL DATABASE - Logical Record Format											
S	EGMENT	FRAME		Pa	age 1 of 7							
R	ECORD	PRIMARY QUESTI	ON RECORD	(por)	-							
No.	F	ield	Size	Format	Comments							
1	Associated referen		1	binary								
2	Associated referen		1	binary								
3	Question no	•	. 1	binary								
2+	Hint Contro - thre - pena	shold	2 2	packed packed	repeated 3 times							
5	– easy	ks possible: mode mode	2 2	packed packed								
6	- reme	-	1	binary binary	Identifies next question in lesson sequence depend- ing on correct- ness of answer.							
7	Screen eras	se flag	1	binary	0 - no erase 1 - screen erased before question frame is displayed							
8	ava	zone rently unused but ilable for further trol fields.	20	binary	zeros							
9	Question to	ext	maximum 1171	Standard Fra Data Block (FDS) format	lines							
					/end							

SCHOOL DATABASE - Logical Record Format										
s	EGMENT	FRAME	Page 2 of						7	
R	ECORD	HINT INFORMATI	ION RECORD	(HIR)						
No.	F	Field	Size	Forma	t	(Comm	ents	,	
1	Associated refere	subject - ence no.	1	binary						
2	Associated refere	lesson ence no.	1	binary				·		
. 3	Associated	question no.	. 1	binary						
<u> </u>	unused		1	binary :	zero		alig urpos	nment es	5 .	
5	1		2 2) binary) halfwo:) repeated 3) times. Start) addresses are) relative to) Hint Text) datum.				
6	Hint Star	imum of 3 blocks of t Text, each in ndard FDB format x. size of each :	maximum (total) 885	Standar Frame D Block (format	ata	each hint max. 4 lines on screen; displayed on next available				
								/end		

SCHOOL DATABASE - Logical Record Format									
S	EGMENT	FRAME	Page 3 o						
R	ECORD	PRIMARY ANSWER	CR RECØRD (PAR)						
No.	F	rield	Size	Format		Comments			
1		ed subject - nce no.	1	binary		·			
2		ed lesson nce no.	1	binary					
3	Question	no.	1	binary					
4		no. attempts d at question	2	packed					
5	Standard	reply flag	1	binary	- E	not set set			
				•	cor ass to spe and 'Co	set, answer nments are sumed not be ecified, d standard orrect/correct's sages will generated.			
6	Answer d	isplay flag	1	binary	I If co an be af in	- not set - set, rrect swer will displayed ter final correct tempt.			
7	Punctuat flag	cion removal	1	binary	1 If pun cha rem to	- not set - set set, common ctuation racters are oved prior answer cking.			
						/Contd			

	SCHOOL DAT	'ABASE –	Loç	gical Re	cord	For	mat			
S	EGMENT	FRAME			Pag	je	4	of	7	
R:	ECORD	PRIMARY ANSWE	R RECORD	(PAR)) /Contd			••		
No.	F	rield	Size	Forma	t	(Comm	ents	,	
8	Space rem	Space removal flag 1 binar				1 - If spa cha rem to	set, set, ce ract	, all ters l pri ver	l are	
9		ve entries within ontrol Block	1	no. a (of a defir				Ters to the answers all types fined withi		
10	- 12 entradefined Aconsisting	ontrol Block (ACB ries (one per Answer) each ng of the g fields: ory code	1	binary	Defines answer ty 0 - Prime 1 - Acception 2 - Non- acception			type ime cepta n-	able	
	- Defin	ition mode	1	binar	У	1 - X'F (i. ans	key fo F'- e. n wer eckin	ng ed)	t 11 y	
							/0	ontd	•••	

SCHOOL DATABASE - Logical Record Format								
SEGMENT FRAME				Pag	ge 5 of 7			
R:	ECORD	PRIMARY ANSWE	R RECORD (PAR) /Contd					
No.	F	'ield	Size	Format	Comments			
	- Comme	nt cross- reference	1	character	 i) 'A' to 'F' identifies associated comment in CIR. ii) space null; use standard system comment; no CIR entry. 			
	- Lengt	h		binary	defines actual length of answer definition as held in the Answer Definition Block (ADB).			
	Ad	ive Start dress	2	binary	address of associated Answer definition within the ADB, relative to the start of the ADB.			
	wi fi	y unused entries thin the ACR are lled with FFFF'		-				
					/Contd			

	SCHOOL DATABASE - Logical Record Format								
S	SEGMENT	FRAME				Page 6		of	7
F	RECORD	PRIMARY ANSWER RECORD (PAR) /Contd.					• •		
No.	F	ield	Size	binary (X'FF') character; exactly as entered (except for keyword definition mode, when initial /KW' is removed		Comments))) repeated as) many times) as there are) action) answers.)))			
11	- answei	finition Block start flag definition	1 maximum 69						
- termir		nator 2		binary		X'FFFF'			
							/1	End.	

			Logical Record						
SEGMENT RECORD		FRAME				je	7	of	
		COMMENT INFORMATION RECORD (CIR)							
No. Field 1 Associated so reference 2 Associated 1 reference		'ield	Size Forma		t		Comments		
			1	binary binary					
			1						
3	Question	Question no.		binary					
Block (- identification of comment of comme		Text: mum of 7 blocks maximum stand comment Text, each (total) Frame tandard FDB 1043 Block				repeated times; st addresses are relat to Commer Text datu X'FFFF if unused ard each commer Data max. 2 lir (FDB) on screen:			
							/E	End	

APPENDIX 3.2 - SCHOOL Database : Table of maxima

Item		Max.value
System :	no. subjectsno. global messages	50 10
Subject :	no. lessonsno. subject messagesno. students	40 10 100
Lesson :	no. framesno. glossary entries	40 40
Frame :	 no. hints no. answer definitions: correct incorrect no. comments 	3 8 4 7

APPENDIX 3.3 - SCHOOL Database : Logical Record sizes.

	Record name	Mnemonic	Id. Code	Data size			
				bytes	no.DBTU's		
1	Master Control Record	MCR	01	1092	6		
2	Bit Map Table	BMT	-	4000	20		
3	Global Message Record	GMR	02	max.1185	max.7		
4	Student Reference Table	SRT	06	max.36,01	max.19		
5	Student Performance Record	SPR	07	222	2		
6	Subject Control Record	SCR	03	max.644	max.4		
7	Subject Message Record	SMR	04	max.1190	max.7		
8	Lesson Control Record	LCR	05	max.980	max.6		
9	Lesson Analysis Record	LAR	08	max.979	max.6		
10	Glossary Reference Table	GRT	OE	max.1080	max.6		
11	Syntax Information Block	SIB	09	390	3		
12	Glossary Definition Record	GDR	OF	max.223	max.2		
13	Primary Question Record	PQR	OA	max.1213	max.7		
14	Hint Information Record	HIR	ОВ	max.901	max.5		
15	Primary Answer Record	PAR	ос	max.946	max.5		
16	Comment Information Record	CIR	OD	max.1081	max.6		
					* assumes 190 bytes/ DBTU for data		

APPENDIX 4.1 - Common Word Analysis (1)

This Appendix contains a full list of the 679 commonest words in the English Language as extracted from Dewey (35), West (34) and Thorndike & Lorge (36) and merged as described in Chapter 4. The list is in alphabetic order and the frequencies shown represent the number of occurrences of a particular word in a sample of 100,000.

FILE: WORDS	DATA A	COMPUTER POWER CANNOCK	- PO	WERSHARE	INTERACTIVE
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	2120 152538047123563671879250655700521333465080872365857008 136723222667243338570052228233386508 32	D E E NOT THE NOTE OF THE NOTE		480220001445886535414700217183313229040113345844387323 1 4536522334225232290204379253222253332222233422229322	
BEGINNING	27	COMES		23	

FILE: WORDS	DATA	A COMPUTER	POWER CANNO	ck -	POWERSHARE	INTERACTIVE
COMMINATION OF THE CONTROL OF THE CO	222232242393222222222222222222222222222	8 5 1 3 2 7 2 3 6 3 1 0 8 2 0 8 2 1 0 3 0 0 5 0	H SH SH SH SH SH SH SH SH SH		9424114033084723002004410509271956135306355273659930679 24292122335232622233252243242234224353323243533234432222338 1	

1 %

GIRL GIVE GIVE GIVE GLAD GLAD GO	FILE: WORDS	DATA A	COMPUTER POWER CANNOCK -	- POWERSHARE INTERACTIVE
HOURS 26 LIKE 113 HOUSE 53 LINE 52 HOW 124 LINES 27 —HOWEVER 22 —LIST 21	GGIVAD G FD SN F F Y SINCE GGOODOTVEREUW S FD SN B TO GGOODOTTVEREUW S FO GGOODOTTVEREUW S FO G	276130020607413543186200107107530195270641752301 155532224218620036622232222202435122632 25122632	HUSBAND I 'MA AND SE YIO I 'MA AND SE YIO I 'MA AND SED THANT IMPOSSIFIED SELF INCEESTRAT INCEESTRAT INCEESTRAT INCEESTRAT INT SELF INCEEPT DGWWLN INT SELF INCEEPT DGWWNSU INCEE	20 1155 20 20 20 20 20 20 20 20 20 20 20 20 20
HUNDRED 21 LIVE 54	HOURS HOUSE HOW -HOWEVER -HUMAN	26 53 124 22 21	LIKE LINE LINES	113 52 27

- 32 -

Contract of the Contract of th

FILE: WORDS	DATA A	COMPUTER POWER CANNOCK	- POWERSHARE	INTERACTIVE
LIVING HAS BE TO AT HE AL RY ANALY ANALY ANALY MEEMN HILLINES RNY HS HT LE OOR MAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	2254031820056264301073605479129542370420522223370562643010736054791295231455267004363071335	NEEDDR TT H NG NOTTH BEO SI SHEEL TO NEEVE THE HEAD SI SHEEL THE NOORTH HOOM NOTTH BEO SI SHEEL TO SHEEL THE NOORTH NOOM COFFERENCE OF THE SI SHEEL TO SHEEL THE SHEEL	21194461889410218322732735398951488951335697493930167022 1944618892218322222225745889513335697493930167022 239422222222222257488951335697493930167022 3	

FILE: WORDS	DATA A	COMPUTER POWER CANNOCK -	POWERSHARE INTERACTIVE
SURE TAKEN TAKEN TAKEN TAKEN TAKEN TAKEN TAKEN TALL TEN N THAT THAT THAT THE THEM SELVES THEY GS THINKD THIRD THERESE THEY GS THINKD THIRD THINK THOUGHT TOOM AND THREE TOOM AND TOOM TOOM TOOM TOOM TOOM TOOM TOOM TOO	21	TURNED TWENTY TWO UNDER UNDERSTAND UNLESS UNTIL UP UPON USE USED VALUE VARIOUS VERY VIEW VOICE WAIT WALK WALL WANT WANTED WAR WAS WATCH WATER WAY WE WEEK WELL WENT WERE WHAT WHEAT WHEAT WHEAT WHEAT WHERE WHAT WHERE WHAT WHERE WHILE WHILE WHILE WHOLE WHOSE WHY WIFE WILL	30
TAKE	20	IMENTY	30
TAKEN	46	INDED	108
TAKING	22	UNDERSTAND	21
TALK	20	UNLESS	21
TEA	22	UNTIL	50
TELL	51	UP	204
TEN	24	UPON	129
THAN	194	US	123
THANK	1765	USE	64
THATIC	1343	USED	45
THE	7310	VALUE	21
THEIR	315	VERY	145
THEM	228	VIEW	29
THEMSELVES	34	VOICE	20
THEN	115	VOTE	22
THERE	306	WAIT	20
THEREFORE	22	WALK	20
THESE	152	WALL	20
THINC	4/8	WANI	94
THINGS	82	WANTED	214
THINK	73	MAG	839
THIRD	22	WATCH	20
THIRTY	24	UNLESS UNTIL UP UPON US USE USED VALUE VARY VIEW VOIE WALK WALK WANT WANT WANT WANT WANT WANT WANT WANT	39
THIS	572	WAY	104
THOSE	104	. ME	529
THOUGH	38	WEEK	25
THOUGHT	6/	MELL	113
THUUSAND	75	WENT	305
THROUGH	78	LIHAT	253
THUS	43	WHEAT	32
. TIME	205	WHEN	237
TIMES	27	WHERE	83
TO	2924	WHETHER	31
TODAY	85	MHICH	454
TOGETHER	25	MHILE	78
TOO	57	MUTIE	26.8
TOOK	40	WHO! F	45
TOWARDS	29	Мном	28
-TO!NN	29	-WHOSE	42
TRADE	21	WHY	51
TREE	25	WIFE	20
111222		MILL	445
TROOPS	26 21	WIND	20
TROUBLE	30	WINDOW WISH	20 28
TRUE TRULY	30	WITH	727
-TRUTH	21	-WITHIN	29
-TRY	27	-WITHOUT	70
TURN	51	MOMAN	59

FILE: WORDS	DATA A	COMPUTER P	POWER CANNOCK	- POWERSHARE	INTERACTIVE
WOMEN	47				
WONDER	20				
WON'T	326				
WORD	35				
WORK	83				
WORLD	103				
WORTH	22				
WOULD	252				
WRITE	21				
WRONG	32				
YEAR	59				
YEARS	93				
YES	23				
YESTERDAY	33				
YET	68				
YOU	775				
YOUNG	41				
YOUR	214				
YOURS	56				

APPENDIX 4.2 - Common Word Analysis (2)

This Appendix contains a list of the 572 most common English words of 6 characters or less in length, as extracted from the list at Appendix 4.1. The words are sorted into descending frequency order.

FILE: CHAR6D	DATA A	COMPUTER POWER CANNOCK	- POWERSHARE INTERACTIV
	DATA 10830466355703770837728843777288437772884377728843777288437772884377728843777288444310881088615650637322222222222222222222222222222222222	COMPUTER POWER CANNOCK YOUR ANYE MORW NOW ITIME DO TNANY MADDER OTHANY MADDER OTHON MUSTPPE MANN MENTPPE MANN MANN MENTPPE MANN MANN MENTPPE MANN MANN MENTPPE MANN MENTPPE MANN MENTPPE MANN MENTPPE MANN MENTPPE ME	- POWERSHARE INTERACTIV 214 210 210 210 208 205 204 203 197 194 189 188 170 166 163 163 161 160 156 153 152 152 146 145 145 145 145 145 145 145 145 145 145
-HER WAR	222 214	MANY	105 104

FILE: 0	CHARED DA	A AT	COMPUTER POWER CANNOCK	-	POWERSHARE	INTERACTIVI
HE D R D NN GST YE GS E T E NYGY E WETSOLITES HE NY		1044433211099754431996666533298777777777777777766887744333322000 110099754431998888888887777777777777776666666666666	CECHNARY OT LIVER DSD E TERES E LA		999988887777665443333332222222111110000998888876666666666666666666666666666	

FILE:	CHAR6D	DATA	A	COMPUTER	POWER	CANNOCK	-	POWERSHARE	INTERACTIV
N E G G G G C C C C C C C C C C C C C C C			4444444444444444444444444444444444443333		AOPPGULROORDWADEROASAVSLTLUEEERNEEVKRITEMITMEOEVNEAOPLKNCK TMPPGUUOOOAAAONYONEYEAYOEAAERNAEEVKRITEMITMEOEVNEAOPLKNCK SAAFFFWBBELLCEEFKLMRSSTBCCFFFGHKLLMMMNNPRRWWEHKORSSAABBC	URLDYKLY L STWDELLETDTLEEL S GSR R RN GYN L MEEL S HELETDTLEEL S HER R RN GYN L MEEL S CONTROL Y EITHDBNHAANMIDNLWPE KONTROL K		6555555444433333333333332222222222222222	

11

F	ILE:	CHAR6D	DATA	A	COMPUTER	POWER	CANNOCK	-	POWERSHARE	INTERACTIV
FFHHIKKLIPRSTTTTCFHIMPSTVWAAABBCDLXXRRSSSWWWDFFHLMMEOO	IAGEO'NNOOREERRUWOUEDLIAHOLIICURORLEOOOGELEELHIURAKA CAY			333333333333333333333333333333333333333		PPQRRSSTTCEHHILMPPSTVAABBFGHHLLLMOSSTWBBCCCDEFFIMMNSSSTTW	ND KE		TOWERS 177777777666666666665555555555555555555	

FILE: CHARED DATA	A COMPUTER P	OWER CANNOCK - POWERS	SHARE INTERACTIVE
ACROSS AIR ACROSS AIR BEGRAN CARRY CHIER COMMINR CLEAR COMMINR CLEAR COMMINR CLEAR COMMINR COUT DIDGHTT EXCEPE GAIN MATAR MEDARAN MODERA MODER	23 23 23 23 23 23 23 23 23 23 23 23 23 2	CAN'T CHANGE COST DESIRE DOOR EAST EFFORT FIGHT GLAD GREEN	21 21 21 21 21
-WORTH -ALONE BLACK	22 21 21	-PLANT -RED ROUND	20 20 20

FILE: CHAR6D	DATA A COMPUTER POWER CANNOCK - POWERSHARE INTERACTIVE
SAT SMILE SORT STAR START	20 20 20 20 20 20 20
STEP STOOD STOP STORY TABLE	20 20 20 20 20 20 20
TALK TRIED VOICE WAIT	20 20 20 20 20
WALK WALL WATCH WHITE WIFE	20 20 20 20 20 20 20 20 20
WIND WINDOW WONDER	20 20 20

APPENDIX 4.3 - Details of Common Word Dictionary creation programs.

PROGRAM	LANGUAGE	DICTIONARY SIZE	WORD LENGTH
CATCOMP1	Assembler	512 or 1024	≤ 5 charcters
CATCOMP2	Assembler	512 or 1024	≤ 6 characters
CATCOMP3	Assembler	631	≤ 6 characters

The following pages tabulate all results obtained during CATCOMP1/2/3 processing:

(a) Results obtained using a compound word list with entries up to 5 characters long (No. entries = 472, Table either 0.9219 or 0.4609 full).

ASCENDING FREQUENCY

TABLE		NDING FIGGODI		
R SIZE	5	12	10	24
	N	A	N	А
1	1620	3.4322	713	1.5105
2	1515	3.2097	709	1.5021
3	1423	3.0148	702	1.4872
4	1502	3.1822	691	1.4639
5	1487	3.1504	704	1.4915
6	1483	3.1419	695	1.4724
7	1415	2.9978	678	1.4364
8	1457	3.0868	708	1.5000
9	1382	2.9279	*674	1.4279
10	1453	3.0783	689	1.4597
11	1369	2.9004	*674	1.4279
12	1373	2.9088	677	1.4343
13	1454	3.0805	703	1.4894
14	1486	3.1483	703	1.4894
15	*1349	2.8580	725	1.5360
16	1354	2.8686	735	1.5572
. 17	1408	2.9830	710	1.5042

Whre N - Total number of insertion attempts

A - Average search length

R - Quadratic Constant

DESCENDING FREQUENCY

TABLE R SIZE	512		10	024
	N	А	N	A
1	1612	3.4152	709	1.5021
2	1563	3.3114	722	1.5296
3	1476	3.1271	686	1.4533
4	1558	3,3008	688	1.4576
5	1451	3.0741	694	1.4703
6	1529	3.2394	709	1.5021
7	1373	2.9088	*677	1.4343
8	1388	2.9406	686	1.4533
9	1451	3.0741	692	1.4661
10	1365	2.8919	688	1.4576
11	1439	3.0487	681	1.4427
12	1391	2.9470	688	1.4576
13	1412	2.9915	719	1.5233
14	1384	2.9322	701	1.4851
15	1352	2.8644	709	1,5021
16	*1330	2.8177	732	1.5508
17	1427	3.0233	712	1.5084

Where N - Total number of insertion attempts

A - Average search length

R - Quadratic constant

(b) Results obtained using a compound word list with entries up to 6 characters long. (No. entries = 572, table 0.5586 full).

ASCENDING FREQUENCY

TABLE		
R SIZE	1024	
	N	A
1	930	1.6258
2	917	1.6031
3	921	1.6101
4	916	1.6013
5	905	1.5821
6	936	1.6363
7	910	1.5909
8	922	1.6118
9.	*887	1.5506
10	927	1.6206
11	906	1.5839
12	909	1.5891
13	947	1.6555
14	953	1.6660
15	953	1.6660
16	935	1.6346
17	917	1.6031

Where N - Total number of insertion lengths

A - Average search length

R - Quadratic constant

DESCENDING FREQUENCY

TABLE R SIZE	102	4
- 5122	102	4
	N	A
1	928	1.6223
2	935	1.6346
3	*893	1.5611
4	908	1.5874
5	919	1.6066
6	948	1.6573
7	917	1.6031
8	909	1.5891
9	918	1.6048
10	904	1.5804
11	910	1.5909
12	930	1.6258
13	949	1.6590
14	957	1.6730
15	947	1.6555
16	960	1.6783
17	924	1.6153

Where N - Total number of insertion lengths

A - Average search length

R - Quadratic constant

(c) Results obtained with entries up to 6 characters long (No. entries = 572, table fullness 0.9065)

DESCENDING FREQUENCY

TABLE	ranna (ur)	ele Ellia
R SIZE	631	
	N	A
1	1608	2.8111
2	1662	2.9055
3	1543	2.6975
4	1670	2.9195
5	1512	2.6433
6	1537	2.6870
7	1617	2.8269
8	*1475	2.5786
9	1532	2.6783
10	1624	2.8391
11	1600	2.7972
12	1593	2.7849
13	1711	2.9912
14	1698	2.9685
15	1601	2.7989
16	1706	2.9825
17	1584	2.7692

Where N - Total number of insertion lengths

A - Average search length

R - Quadratic constant

APPENDIX 4.4 - Optimum Common Word Dictionaries.

This Appendix contains prints of the best Common Word Dictionaries (CWD's) evolved during SCHOOL testing. Two sets of output are included:-

- (i) CWD of words < 5 characters long (table size 512);
- (ii) CWD of words < 6 characters long (table size 631).

CAT RESEARCH	- COMMON WORD DICTIONARY	CREATION	(TABLE SIZE:	512)
ENTRY NO.	TEXT WORD NIGHT PLANT BROAD	HASH VALUE 0 198 2		
1 2 3 4 5 6 7 8 9	NOT FIELD CRY WHEN BOTH	4 5 6 7 8		
10 11 12 13 14 15 16 17 18 19 20 21	STAND LAW GLAD FOOD TRY FULL LEAST MARRY STEEL WHAT DEAR	10 507 434 509 14 15 458 496 18		
21 22 23 24 25	DRAW NOW OTHER	22 7 24		
26 27 28 29 30 31 32	STILL ENEMY ENTER EARLY MANY EIGHT SHOW	26 11 507 13 30 510 32		
33 33 33 33 33 33 33 44 44 44 44 45 45 55 55 55 55 55 55 55	STATE UPON ASKED DEEP KNOWN HOUSE FLOUR SCENE FOUR IF BLACK STORY NEEDS FIGHT RUN GREEN PRICE EACH CAUSE AM AN GIVEN	18 19 3 48 20 48 263 11 18 17 18 17 18 17 18 19 49 41 51 51 51 51 51 51 51 51 51 51 51 51 51		

57		
58 59	IN	58 43
60 61 62	GREAT -	61 62
62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79	TOLD NO LONG AS AT MR LOAN IS TO SAT EVEN TEA WHOLE TALK EVER	64 65 66 67 68 323 70 71 72 380 74 476 76 456
80 81 82 83 84 85 86 87 88 89 90 91 92 93	MARK PULL COAL ABOVE TAKEN POOR UNDER HAD IT WRITE DID GO MEAN	10 81 66 50 51 85 86 87 72 19 90 58
95 96	OFF	95
97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114	ARMY SHE VERY STOP RISE SMATEN BOOKS LOVE DROP HIM LAY MER THESE RESUND NEXT WHO	97 98 99 407 68 86 87 104 72 273 107 509 109 110 111 112 97 81 99 116

129 130 MORE 131 TODAY 132 THUS 133 134 BUT 135 FREE 136 MOVE 137 WITH 138 FIND 139 OUT 140 WILL 141 IT'S 142 OWN 143 COULD 144 OVER 145 WRONG	107 124 125 126 127 128 129 130 131
146 147 148 149 149 150 WHY 151 152 153 154 155 WELL 155 WELL 156 WENT 157 USED 158 159 HOME 160 FEET 161 161 KNOW 162 163 164 165 GUNS	134 119 136 137 122 139 140 121 145 144 145 148 138 138 139 156 163 162 163 163 163 163 163 163 163 163 163 163
166 167 168 MUST 169 FILL 170 WALK 171 FRONT 172 BUY 173 STOOD 174 BEST 175 FACT PARTY	134 168 136 137 171 139 399 158 142 86

177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208	DONE VIEW RIGHT ALONG LIFE WEEK CLEAR CAMILE FAIR LIKE WANT WALL TIME CASE PLACE GAIVE GIVE WIND I'M YET NOTE LEAR VOIE TAKE	126 88 120 181 1350 1874 1357 155 138 190 191 193 126 197 128 199 129 129 129 129 129 129 129 129 129
205 206 207 208	CENTS FOUND WOULD	206 207 208
209 210 211 212 213 214	LEFT GAIN WOMAN LADY WOMEN	210 195 212 213 214
216 217 218 219	SORT AGE FEEL PART	34 217 128 219
212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228	LORD FEAR AND END AMONG THE MEANS	65 132 223 224 174 226 227
227 228 229 230 231 232 233 234 235 236	NEED SON STAR AGO TRUE GIRL	51 121 143 234 202 203

237 238 239 240 241 242 243 244 245	ALL AIR LAST MILES ARM ARE THOSE IDEA	237 238 223 224 241 226 243 174
246 247 248 249 250 251 252 253	HIGH HAND MAKE TOO NEVER HERE	247 248 249 250 251 252
244789012345678901234	WHOSE ERECTED BY AND	25537290822349672941252222222222222222222222222222222222
295 296	CUT MONEY	262 296

297 298 299 300 301 302	HE ROOM STEP DOING NEAR	297 208 143 267 70
303 304 305 306 307	ME FIRST OF DRESS OH	303 304 305 236 307
309 310 311 312 313 314 315 317 318 319 320 321 3221 3223 3224 3225 3227 3228 3230 3331 3331 3331 3331 3331 3331 3331	KNOWS POUND PAPER WE ALOME LIST GOUNE HOURS ON YOURM HEURS ON YOURM THEN SO BY ASH TRHEN SO BY CLAUTLD CABOUT TIMES THAT WORLES THAT WHORLES THAT WH	51 240 3112 108 314 225 316 327 230 305 272 324 3227 329 3298 3298 3298 321 329 321 329 321 329 321 329 321 329 321 321 321 321 321 321 321 321 321 321
345 346 347	THEY	345 256
348 349 350 351 352 353 354 355 356	BIG LOOK HANDS TOOK SEE REAL MY OLD US	348 333 350 335 352 320 338 355 340

357 358 359 361 362 363 364 365 3667 367 377 377 377 377 377 377 377 37	ONE YEARS HEARD THERE THERE THERE SEAST TRAD USE CONST TRAD USE CONST TRAD USA THEAD H GOUST THEAT THE	7862523891728416345518301234567894023490689 555264664466515757770622763888888887499278499 278689
400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416	SAY NORTH SINCE SAVE ORDER DOWN THINK THREE FINE ALSO BREAK ART SEND THING SET HOPE	385 3888 406 406 375 123 395 308 308 308 308 308 308 308 308 308 308

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417 418 419	HAPPY DOOR	366 402
420 421	HEAD MOST	239 420
422 423	KEEP THANK	389 372
424 425	KNEW OPEN	408 392
426 427	FORTY HEART	375 357
428 429	BEGAN	396
430 431 432	TRULY HOLD	340 380
433 434	L EAD CLOUD	432
435	WAIT LARGE	149 420
437 438	ROAD BEAR	437
439	ABLE BANK	439 389
441	AFTER TREE	441 442
443	WISH LINE	392 444
445	WIFE VOICE	375 290
447	LIGHT	447 448
449 450	LATE CLOSE	449 434
451 452	MHICH	451 452
453 454	CALL	453
455 456	HARD WHILE	250 456
457 458	LAND WHERE	441 458
459 460	ROUND	304
461 462	KEPT SENT	410 411
463 464 465	CARRY WHITE DRIVE	463 464 465
466 467	OFFER	467
468 469	CHILD	357 453
470 471	ADD CENT	470 471
472 473	PLAY UNTIL	472 473
474 475	AWAY CARE	474 442
476	WHEAT	476

477 478 479 480 481 482	F	MRS PASS MIGHT GROW CAN'T	132 478 479 480 411
44444444444444444445555555555555555555		GOD CITY CHIEF CAN JUST JUST JUST JUST JUST JUST JUST JUST	24556789082889678908131567890 4456789082889678908131567890 555555555555555555555555555555555555
	NO. CARDS REA	AD	472
	TOTAL NO. INS	SERTION ATTEMPTS	1330
	AVERAGE NO. 1	MATCHES	2.8177

CAT RESEARCH	-	COMMON	MORD	DICTIONARY	CREATION	CTABLE	SIZE:	631)

ENTRY NO. 0 1 2 3 4 5 6 7 8	TEXT WORD OUR THEN WELL FOUR PLACE ROOM CHURCH	HASH VALUE 0 1 625 626 618 609 610	
9 10 11 12 13 14 15 16 17 18 19 20	HIS FALL OUT ENOUGH BE STEEL ALL NOTE ONLY THEM SO COULD THEY HARD	8 9 10 625 12 13 14 15 16 0 18 19 20 13	
21 22 23 24 25 26 27 28 29 30 31	OPEN EVER OFFER HELD MANY FAR EVEN KNOW	23 16 618 18 19 20 12 30	
32 33 34 35	CAN'T WORK	15 33	
36 37 38	WORD STAND I'M	19 29 11	
39 40 41 42	LEAD HOME FAIR	2 41 610	
43 44 45 46 47 48 49 50 51 52 53 55 56	OLD BATTLE MAN BY ENEMY MADE LIVE LEFT LOST GREAT NEVER GO WHITE	44 45 46 47 40 49 33 51 44 53 54 47	

OVER NEXT EXCEPT AWAY TELL GUN SOUTH HELP MAY UPON ASK POINT	57 41 59 60 61 54 617 37 65 66 67 68
FUTURE WITHIN HORSE DOCTOR WORLD CHANCE CALL YOUR TALK SAYING TROOPS VOICE	20 71 9 46 66 58 76 77 412 2 3
ALSO MONEY OF WIFE OH STEP	66 84 85 86 87 594
STILL AGE THINGS SAW WOMEN SAY	90 83 92 93 94 95
SAT FRIEND ON VERY LIGHT THING OR WHILE	90 622 100 101 94 103 104 105
CHARGE WHERE PROPER LOOK SIDE KNEW FIVE THINK SEEN CASE	99 100 109 110 84 95 113 114 77
	TEYL H T EN R E GS EXCAPL TP N N UHSTODC NPE EXCAPL TP N N UHSTODC EXCAPL TP N UHSTO

117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144	AGO TRUTH PASS SEEMS FULL TRUETE PULL NEEDN PASE SHOULL NEEDN PASE SHOULL MISS HEACHER SINCER GROWNES AFTOW L GOLEAR RATHD NEED TURN TAKE CLASS WIND	100 91 1120 121 84 115 116 125 92 120 1131 132 1334 130 120 130 140 144 144 144 144 144 144 144 144 14
147 148 149 150 151 152 153 154 155 156 157 158 159	WRONG CLOSE CRY LAW WALL LAY COVER HAPPEN DEEP END MONTH	147 111 133 151 346 153 154 128 118
161 162 163 164 165 166 167	TAKING INDEED RED KIND LABOUR SECOND KING	145 163 613 165 166 159 168
169 170 171 172 173 174 175	PLAN MONTHS LAUGH BEING SAID	170 171 172 173 174

177 178 179 180 181	LOVE PER MAKES	151 179 180
182 183 184 185 186 187 188 189 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 207	REALLY NATURE DONE HOW WHAT THANK FIELD IT'S BROAD BLACK SOUND YEAR PARTY HOPE FIRE PLAY TEAA AMOUND GAIN SUN ME VALUE	182 133 176 185 186 187 188 189 190 174 184 178 196 189 361 199 200 163 202 203 196
206 207 208	DRIVE MEAN BACK	168 207 208
208 ,209 ,210 ,211 ,212 ,213 ,214 ,215 ,216 ,217 ,218	EIGHT DAY WEEK DROP MEANS THERE FIGURE LIKE WANTED	210 211 195 186 214 215 208 217 218
219 220 221 222 223 224 225 226 227 228 229	STAR EARTH BOOKS OTHER COURSE SHIP PUBLIC ALONG FEAR ABLE	203 221 222 215 224 208 226 227 103 229
230 231 232 233 234 235 236	TAKEN MOST PEOPLE KEEP SIR FATHER	223 232 233 226 235 198

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237 238 239 240 241 242 243 244 245 246 247 248 250 251 252 253 255 256	HER MY THAN BOTH COST REASON WANT GOLD BEST ANSWER PAPER POUND SIX WHOLE ALWAYS CENT THAT WERE WHO GOD	237 238 239 232 191 243 227 238 247 238 247 248 249 225 253 255 255 255 239
257 258 259 260 261 262 263 264 265 266 267	FAMILY HAND GUNS YEARS MUST ALONE REACH POOR ITS	258 251 168 261 262 225 226 238 266
268 269 270 271 272 273 274 275 276	ABOUT POUNDS GOT LORD SIT WILL TO LATE THREE LESS	268 261 270 233 245 273 274 225 276 277
278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296	COMMON CAN WHY ARE MIGHT TOWN WHOSE HE GIVEN TRADE ARM LIE BEGAN ROAD HERE TABLE RIVER WHEAT	279 280 273 274 266 276 277 286 287 289 273 291 265 293 151 232 296

297 298 299	I'LL REMAIN	247 235
300 301 302 303 304 305	NOT GIVE ONCE NOW ART	300 301 302 303 304
306 307 308	VIEW MATTER ONTO	306 307 308
309 310 311 312	TIMES HOUSE RETURN	302 303 285
311 312 313 314 315 316 317 318 319 320 321 322 323	BOYS DESIRE FACE LIFE CAME WONDER	276 307 316 300 318 269
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342	KNOWN MAKING MOMENT BETTER TOO WAIT GLAD NOR JUST DID DIE WOMAN TWENTY CITY GET CARE LITTLE STOOD MOVE PART LEAST KNOWS UNDER	321 322 273 324 317 320 290 330 331 331 332 316 335 337 337 339 340 216 334
344 345 346 347	HUMAN FACT	328 346
348 349 350 351	FOR DON'T FRONT POWER	348 349 350 351
352 353 354	WALK	345 354
355 356	FORM	329

357 358 359 360 361 362 363 365 365 366 367 368 371 372 371 377 377 378 379 381 382 383	BEHIND DEAR WAR WOULD MILES COURT COME GOOD COLOUR WISH OFFICE WAS OTHERS SEND BEEN HALF COMING WAY STRIKE NEW YOURS THUS HOUR RUN TEN GAVE	3498 3590 3590 3590 3590 3590 3590 3590 3590
384 385 386 387 388 389	HIGH MR HEAVY LIVING INTO ARMY TREE	384 223 359 360 388 389 382
391 392 393 394 395 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416	THOSE CENTS WE SCHOOL SHOW COMES GIRL BANK EYES DURING AM AN SON PRETTY FIRST THIS USED SOON SAVE APPEAR MYSELF FOLLOW HEARD AMONG AS	3764567899212334967892423656 4004404404413656

417 418 419 420 421 422 423 424 425 426 427	AT CALLED PRICE RISE CHILD MORE HOLD FOUND ALMOST FEW	417 401 411 393 394 422 415 416 425
428 429 430	SENT WHICH LEARN	401 429 422
431 432 433 434 435	PAY FIND LAND AROUND	432 433 426 397
43333901234567890123456789012345678901234544444444444444444444444444444444444	HEART NIGHT MEN MARK ED DING TRULY FIGHAK FREALER BRESELER MEMBER SEATHON SEE HAD SEATH HEAD EFFT HHEAD BRESELER TOCT SEE HAD EFFT HHEAD SEE HAD SEE H	7890343428989034434393344448333444454455728855539408678901234448444444444444444444444444444444444
474 475 476	LONG DRESS NO	474 412 476



477		
478 479 480 481	MAKE LOW PLANT	478 479 208
4823 4884 4885 4886 4887 4888 4890 4991 4992 4994 4996	GREEN SET HAS BEFORE ENTER HEAR SMILE CHANGE FEEL START SUPPLY I DEA ABOVE RIGHT	432 483 484 485 486 479 411 451 493 494 495
497 498 499 500 501 502 503 504 505 506 507 508 511 512 513 514 515	SHORT SMALL READ TRIED THIRD THE NATION OFF ACROSS LARGE WHOM BUT BIG MUCH AND SOME BUY REAL	470 499 462 493 502 493 505 506 509 509 509 511 512 513
516 517 518 519 520 521 522 523 524	OWN WATER WON'T LETTER STORY DRAW YOU FEET THAT'S	508 509 518 502 503 504 522 506 497
525 526 527 528 529 530 531 532 533 534 535	DOES PEACE FLOUR HAVING WENT UP MRS WRITE UNTIL SPEAK DEMAND	526 510 528 502 522 531 524 456 526 518 509

537 538	AO1E	499
539 540	BODY HAPPY	531
541 542	DO MINE	397 541 542 543 527 273 529 547
543 544	IF LADY	543
545 546	MARRY ROUND	273
547 548	ANY	547
549	L ET EVERY	541 542
551 552	CAUSE	543
553 554	PUT EFFECT	553
555 556	AGAIN THEIR	547
550 551 552 553 554 555 556 557 558 559 560 561	ONE	557
559 560	FROM EAST	559 522
561 562	COAL	561
562 563 564	FORCE NAME	545555555555664212 55554767892123758782212 5555555555555555555555555555555555
565 566	WHEN DOING	565 558
567 568	CANNOT SAYS	567 568
569 570	US ASKED	542 562
569 570 571 572 573 574 575 576 577 578 579 580	IS IT	571 572
573 574	EARLY	574
575 576	FILL THOUGH	567 559
577 578	SURE	560
579 580	MIND	541 572
581 582	CARRY	504 582
583 584	UNLESS BECOME	401 534
585 586	YES	585 586
587 588	FORTY ORDER	587 580
589 590 591	SHE	590
592 593	STOP STREET	529 576
594 595	TOOK	594 557
596	YOUNG	588

597 598 599	BECAME DINNER	489 598
600 601 602 603 604	FELT NUMBER OFTEN THIRTY	304 594 586 604
605 606 607 608 611 6112 615 616 617 616 617 618 622 622 625	CHIEF DAYS REGARD FREE SUCH NORTH TODAY PERSON ADD AIR MOTHER LINES SHOULD WATCH SCENE BEAR CLOUD SORT STRONG HIM	598 607 608 609 611 612 613 576 616 617 610 611 603 612 5620 625
626 627 628 629	THESE TWO	626 627
630	LAST	630
	NO. CARDS READ	572
	TOTAL NO. INSERTION ATTEMPT	S 1475
	AVERAGE NO. MATCHES	2.5786

<u></u>		
Program	CATCOMP4	CATCOMP5
Word length	≤ 5 characters	≤ 6 characters
Language	Assembler	Assembler
Size	5017 bytes	6257 bytes
Comments	a fair the same of	

This Appendix contains some examples of output produced by compression testing programs CATCØMP4 and CATCØMP5.

Examples illustrate the use of:

- (i) Common Word Dictionaries of both ≤5 and ≤6 character words;
- (ii) test data derived from the original CPS/CAI system.
 This is used in 2 formats:
 - full text (including many PL/1 like language statements);
 - introductory text (essentially normal English).

Each line of test data is printed twice:

- line 1 is the original format (and is preceded by
 '***');
- line 2 is the compressed version. In this each removed common word (and usually the following space character) are replaced by '||', indicating the embedded compression code.

Statistics assessing the effectiveness of each compression test are printed at the end of the text.

CAT RESEARCH (SCHOOL SYSTEM)

DATABASE COMPRESSION VIA REPLACEMENT OF COMMON TEXT WORDS.

ORIGINAL AND COMPRESSED CHARACTER STRINGS

- COMPUTER POWER TRAINING SCHOOL 28/09/76
- CPS SELF TUITION SYSTEM VERSION: CAI/ML/04
 CPS SELF TUITION SYSTEM VERSION: CAI/ML/04

- EXCEED 15 CHARACTERS FOR EITHER. NAME? LOCATION? EXCEED 15 CHARACTERS | | EITHER. | | | LOCATION?

- PLEASE RE-TYPE YOUR IDENTIFICATION AS IT SHOULD BE. PLEASE RE-TYPE ||IDENTIFICATION ||||SHOULD ||.
- YOU REALLY NEEDN'T WORRY BECAUSE EVERYTHING IS FAIRLY STRAIGHTFORWARD | | REALLY NEEDN'T WORRY BECAUSE EVERYTHING | | FAIRLY STRAIGHTFORWARD
- YOU SHOULDN'T GO FAR WRONG.
- *** IF YOU DO HAVE ANY SERIOUS DIFFICULTIES REFER TO THE INSTRUCTIONS IN
- *** YOUR PI TEXT OR AN EXPERIENCED USER.
 - *** IF AN ERROR OCCURS WITHIN THE SYSTEM ITSELF, IT WILL TRY TO 'RECOVER' |||||ERROR OCCURS WITHIN ||SYSTEM ITSELF, ||||||||RECOVER'
- - *** ACCORDING TO MY RECORDS THE LAST EXERCISE THAT YOU ATTEMPTED WAS

- EXERCISE NO. YOUR SCORE WAS EXERCISE | | . | | SCORE | |
- UNFORTUNATELY ALL RECORD OF YOUR PROGRESS WAS DESTROYED.
- *** I'M AFRAID THAT THIS ISN'T GOOD ENOUGH FOR YOU TO PROCEED AND THEREFORE ||AFRAID ||||ISN'T ||ENOUGH ||||||PROCEED ||THEREFORE
- *** YOU MUST RESIT THE EXERCISE.

- *** EACH EXERCISE.
- *** THIS MEANS THAT YOU HAVE ACHIEVED A SATISFACTORY STANDARD ON THE
- PREVIOUS SECTION AND YOU MAY PROCEED TO THE NEXT EXERCISE. PREVIOUS SECTION |||||||PROCEED ||||||EXERCISE.
- *** RECORD. RECORD.
- *** TRIED WAS NO.
- - *** NOT MUCH LONGER SORRY ABOUT THIS.
 - *** TYPE IN THE EXERCISE NO. ONLY.
 TYPE ||||EXERCISE ||. ||.
- - *** PLEASE TYPE YES OR NO ONLY.

PLEASE TYPE !!!!!!!.

- ON THE LAST EXERCISE.

- DO YOU WISH TO DO THIS? ANSWER YES OR NO.
- IF YOU HAVE ANY COMMENTS ON THE CAI SYSTEM, WE WOULD BE VERY PLEASED TO
- HEAR FROM YOU. PLEASE ADDRESS ANY CORRESPONDENCE TO:-
- *** MIKE LITTLE COMPUTER POWER LTD. WALSALL ROAD CANNOCK MIKE LITTLE COMPUTER ||LTD. WALSALL ||CANNOCK

DATABASE COMPRESSION PERFORMANCE STATISTICS

PROGRAM ANALYSIS:	QUADRATIC CONSTANT (R)	16
	MAX. WORD LENGTH	5
	TABLE SIZE (NO. ENTRIES)	512
INPUT ANALYSIS:	NO. CARDS READ	50
	TOTAL TEXT BYTES	2605
WORD ANALYSIS:	NO. WORDS ENCOUNTERED	463
	AVERAGE LENGTH	4.434
	NO. WORDS FOUND IN DICTAB	285
DUTPUT ANALYSIS:	TOTAL BYTES GENERATED	2022
	STORAGE REDUCTION (BYTES)	583
	COMPRESSION FACTOR (%)	22.380

CAT RESEARCH (SCHOOL SYSTEM)

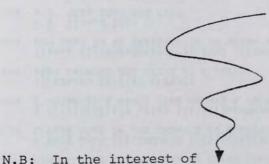
DATABASE COMPRESSION VIA REPLACEMENT OF COMMON TEXT WORDS.

ORIGINAL AND COMPRESSED CHARACTER STRINGS

- *** COMPUTER POWER TRAINING SCHOOL 28/09/76 COMPUTER ||TRAINING ||28/09/76
- CPS SELF TUITION SYSTEM VERSION: CAI/ML/04
 CPS SELF TUITION | VERSION: CAI/ML/04

- LOCATION AS THE SYSTEM USES THESE FOR RECOGNITION PURPOSES. DO NOT LOCATION ||||||USES ||||RECOGNITION PURPOSES. ||||
- EXCEED 15 CHARACTERS FOR EITHER. NAME? LOCATION? EXCEED 15 CHARACTERS | | | | . | | | LOCATION?

- PLEASE RE-TYPE YOUR IDENTIFICATION AS IT SHOULD BE. PLEASE RE-TYPE ||IDENTIFICATION |||||||.
- YOU REALLY NEEDN'T WORRY BECAUSE EVERYTHING IS FAIRLY STRAIGHTFORWARD | | | | | NEEDN'T WORRY BECAUSE EVERYTHING | | FAIRLY STRAIGHTFORWARD
- AND IF YOU FOLLOW THE INSTRUCTIONS RELAYED BACK TO YOU BY THE SYSTEM
- *** YOU SHOULDN'T GO FAR WRONG. ||SHOULDN'T |||||.
- *** IF YOU DO HAVE ANY SERIOUS DIFFICULTIES REFER TO THE INSTRUCTIONS IN



brevity, a large section of output has been omitted

at this point.

- THE OBJECT OF THIS EXERCISE IS TO COVER MOST OF THE ASPECTS OF THE
- PRECEDING SECTION. THE FORMAT OF IT DIFFERS CONSIDERABLY FROM PREVIOUS PRECEDING SECTION. ||FORMAT ||||DIFFERS CONSIDERABLY ||PREVIOUS
- *** EXERCISES SO BE ON YOUR TOES !!
 EXERCISES !!!!!!!TOES !!
- FIRST OF ALL JOT DOWN ON A PIECE OF PAPER A SIMPLE 3-LINE PROGRAM TO:
- *** READ IN VALUES FOR C AND X (IN THAT ORDER)
- CALCULATE Y=X+2C+1 AND PRINT OUT THE ANSWER (WITHOUT AY ACCOMPANYING CALCULATE Y=X+2C+1 ||PRINT ||||||(WITHOUT AY ACCOMPANYING
- HAVE YOU FINISHED? NEVER MIND, HAVE A TRY ANYWAY.
- RIGHT THAT'S RIGHT CORRECT YOU HAVE ANSWERED CORRECTLY
- NOW TYPE A LINE INTO YOUR PROGRAM WHICH WILL CAUSE THE WORD 'ANSWER' TO
- *** BE PRINTED ABOVE YOUR ANSWER

- *** N.B. JUST TYPE ONE LINE N.B. ||TYPE |||
- - *** BEEN PRINTED OUT (LINE 4, PLEASE)
- - *** NOW TYPE IN A STATEMENT TO ERASE LINE 4

IITYPE IIA STATEMENT IIERASE 114

- *** THE LINE NUMBERS NOW NEED TIDYING UP WHAT INSTRUCTION DO YOU NEED TO |||||NUMBERS |||||IDYING ||||INSTRUCTION ||||||
- *** RENUMBER THE STATEMENTS 10, 20, 30 ETC. RENUMBER [|STATEMENTS 10, 20, 30 ETC.
- *** INCORRECT WRONG SORRY THIS IS WRONG BAD LUCK YOU'RE WRONG INCORRECT ||SORRY ||||||BAD LUCK YOU'RE ||
- IF YOU WANT ANOTHER LISTING DO YOU NEED TO TYPE IN ANOTHER STATEMENT?
- WELL, WE'VE FINISHED WRITING THE PROGRAM, LET'S SEE IF IT WORKS!
- *** HERE WE GO, INPUT YOUR DWN VALUES FOR C AND X
- *** DO YOU THINK THAT'S THE RIGHT ANSWER?
- *** THIS IS ILLEGAL INPUT; NUMBERS ONLY PLEASE! WERE THE VALUES AND ?
- YOU MAY SUBMIT THE VALUES ONCE MORE, TAKE CARE!
- *** I'M SORRY EQUALS YOUR ARITHMETIC MUST BE WRONG ||SORRY EQUALS ||ARITHMETIC |||||
- THAT IS THE END OF EXERCISE 5. I HOPE THE CHANGE IN FORMAT CAUSED NO
- *** TROUBLE. YOUR SCORE WAS OUT OF A POSSIBLE 11. THIS IS EXCELLENT GOOD TROUBLE. ||SCORE |||||A POSSIBLE 11. |||EXCELLENT ||
- *** PI TEXT EXAMINE THE CORRECT ANSWERS AND RESIT THE TEST PI TEXT EXAMINE ||CORRECT ANSWERS ||RESIT ||TEST
- *** RE-READ THE PREVIOUS SECTION AND RESIT THE TEST RE-||||PREVIOUS SECTION ||RESIT ||TEST
 - *** WHAT YOU SHOULD HAVE HAD WAS
 - *** EXERCISE 6. EXERCISE 6.
- THIS EXERCISE IS A BIT OF A TRICK REALLY!!
 - *** FIRST OF ALL YOU DON'T GET ANY MARKS FOR IT THE SCORE RECORDED BY THE

- TELETUTORING SYSTEM IS IN FACT THE SAME AS YOU GOT FOR EXERCISE 5.
- *** TRY TO EXECUTE THE PROGRAMS.
- ALL OF THIS WILL BE HANDLED BY CPS ITSELF (AS OPPOSED TO THE SELF-
- TUITION SYSTEM) IN OTHER WORDS YOU WON'T BE MOLLY-CODDLED ANY MORE!!!
 TUITION ||) ||||WORDS ||||||MOLLY-CODDLED ||||!!!

- YOU MUST DECIPHER FOR YOURSELF.
- *** RIGHT THEN HERE ARE THE TWO PROGRAMS:-
- READ IN A NUMBER, RAISE IT TO THE POWER 0.5, PRINT OUT THE ANSWER.
- B) WRITE A PROGRAM TO CALCULATE HOW MUCH TAX YOU PAY PER YEAR, I.E. B) ||A PROGRAM ||CALCULATE ||||TAX ||||||, I.E.
- CALCULATE THE TAX BY TAX = 41% OF (AMOUNT OVER £850 2/9 OF ANNUAL CALCULATE ||TAX ||TAX = 41% ||(||||£850 2/9 ||ANNUAL
- *** EARNINGS), EARNINGS),
- *** PRINT OUT YOUR TAX FIGURE ALONG WITH THE HEADING "TAX TO PAY". FRINT ||||TAX ||||||HEADING "TAX ||||".

 - *** ERASE WHERE APPROPRIATE. ERASE | | APPROPRIATE.
- *** CHEERIO THEN YOU'RE ON YOUR OWN FROM NOW ON !!!
 CHEERIO ||- YOU'RE |||||||||||||
 - ***)XERCISE 7.

DIXERCISE 7.

- *** THIS EXERCISE DEALS WITH LABELS AND GOTO STATEMENTS IN CPS. IT ALSO | | EXERCISE DEALS | | LABELS | | GOTO STATEMENTS | | CPS. | | | |
- ONE ATTEMPT AT EACH QUESTION SO BE EXTRA CAREFUL!
- A LABEL MAY BE INVALID IN CPS FOR ONE OF THE FOLLOWING REASONS:-

- C) THE LABEL NAME INCLUDES AN INVALID CHARACTER.
 C) ||LABEL ||INCLUDES ||INVALID CHARACTER.
- D) THE LABEL NAME IS NOT IMMEDIATELY FOLLOWED BY A COLON.

 D) ||LABEL |||||IMMEDIATELY FOLLOWED ||A COLON.
- CONSIDER THE FOLLOWING EXAMPLES. IF THE LABEL IS VALID TYPE V WHEN THE CONSIDER ||FOLLOWING EXAMPLES. |||LABEL ||VALID TYPE V |||
- *** IN THE NECESSARY ERROR CODES A, B, C, OR D. | | | | | NECESSARY ERROR CODES A, B, C, | | D.
- YOU MAY TYPE IN MORE THAN ONE CODE IF YOU WISH IN WHICH CASE IT IS NOT
- *** NECESSARY TO SEPARATE THE LETTERS. YOU MAY USE EITHER UPPER OR LOWER NECESSARY ||SEPARATE ||LETTERS. |||||||||UPPER ||LOWER
- XXX CASE. WHAT DO YOU THINK THE ANSWER IS? WHAT'S YOUR ANSWER?
- *** NOW TYPE IN YOUR ANSWER. PLEASE REPLY WITH YOUR SOLUTION. ||TYPE ||||||. PLEASE REPLY ||||SOLUTION.
- *** A) LAST: PUT IMAGE(A,P,B)(ONE)
 A) ||: ||IMAGE(A,P,B)(||)
 - B) BEGINNING: Y=0
 B) BEGINNING: Y=0
 - *** C) A-B;GET LIST(X)
 C) A-B;||||(X)
- - *** E) ERROR: TOTAL = TOTAL + 1

- E) ERROR: TOTAL = TOTAL + 1
- F) 1PROC: GET LIST(NO)
 F) 1PROC: ||||(||)
- 7. REPEAT: | IMAGE(1)(HEAD);
 7. REPEAT: | IMAGE(1)(||);
- WRITE A STATEMENT TO CAUSE CONTROL IN THE PROGRAM TO BRANCH BACK TO THE
- *** ABOVE STATEMENT.
- WOULD THE STATEMENT 'GO TO 7' BE VALID IN CPS?
- *** CONSIDER THE FOLLOWING PROGRAM AND ANSWER THE QUESTIONS RELATING TO IT CONSIDER ||FOLLOWING PROGRAM ||||||QUESTIONS RELATING ||||
- *** 1. COUNT, TOTAL=0; 1. COUNT, TOTAL=0;
- 2. REPEAT: IF COUNT > 4 GOTO PRINT; 2. REPEAT: ||COUNT > 4 GOTO PRINT;
- 3. GET LIST(TONS); 3. ||||(TONS);
- 4. TOTAL=TOTAL+TONS; 4. TOTAL=TOTAL+TONS;
- 5. COUNT=COUNT+1; 5. COUNT=COUNT+1;
- *** 6. GOTO REPEAT; 6. GOTO REPEAT;
- *** 7. PUT LIST('PASS'); 7. ||||('||');
- A) WHAT IS MISSING FROM STATEMENT 2?

 A) ||||MISSING ||STATEMENT 2?
- - *** CONTROL PASS?
 CONTROL | | ?
 - C) IF COUNT HAS A VALUE OF 4, TO WHICH STATEMENT WILL CONTROL PASS
 C) ||COUNT ||A || ||4, || ||STATEMENT ||CONTROL ||
- *** AFTER STATEMENT 2 IS EXECUTED?
 - *** D) IF WE WISH TO TOTAL 8 VALUES OF TONS, AGAINST WHAT VALUE MUST COUNT

- *** BE TESTED?(COUNT>?)
- WRITE A STATEMENT TO RESET A VARIABLE DAY TO 0 WHEN IT EXCEEDS > & ||A STATEMENT ||RESET A VARIABLE ||||0 ||||EXCEEDS > &
- *** OTHERWISE PASS CONTROL TO LOOP OTHERWISE ||CONTROL ||LOOP
- IN THE ABOVE STATEMENT, WOULD CONTROL PASS TO LOOP IF DAY HAD A VALUE
- *** OF 6
- *** 50. IF X=10 THEN SUM=SUM+1 ELSE TOTAL=TOTAL+1; 50. | | X=10 | | SUM=SUM+1 ELSE TOTAL=TOTAL+1;
- WHAT IS MISSING FROM THE ABOVE STATEMENT?(TYPE IN THE SYMBOL)
- *** THE RIGHT ANSWER IS BAD LUCK YOU'RE WRONG
- *** WRONG SORRY THIS IS WRONG INCORRECT ||SORRY ||||||INCORRECT
- *** 50. IF X=10 THEN GO TO LAB1; ELSE GO TO LAB2; 50. ||X=10 ||||||LAB1; ELSE ||||LAB2;
- *** 60. TOTAL=TOTAL+SUM; 60. TOTAL=TOTAL+SUM;
- A) X=10 B)X IS NOT EQUAL TO 10 C) NEVER. TYPE A, B OR C.
 A) X=10 B)X |||||EQUAL |||10 C) ||. TYPE A, B ||C.
- *** QUESTIONS 8, 9 AND 10 EACH GIVE YOU A SHORT PROGRAM TO LOOK AT. QUESTIONS 8, 9 ||10 ||||||A ||PROGRAM ||||||.
- -- *** IN EACH CASE YOU WILL BE SUPPLIED WITH THE VALUES FOR THE VARIABLE X
 - AND YOU SHOULD REPLY WITH THE VALUE WHICH YOU THINK THE VARIABLE CLASS
- *** 10. IF X<3.5 THEN CLASS=A; 10. ||X<3.5 ||||=A;
 - *** 20. IF X>=3.5 THEN IF X<=7.5 THEN CLASS=B;

- 20. ||X>=3.5 ||||X<=7.5 ||||=B;
- A) X=7.5 B)X=3.25 C) X=4.0 A) X=7.5 B)X=3.25 C) X=4.0
- *** 10. CLASS=B; 10. ||=B;
- 20. IF X>7.5 THEN CLASS=C; ELSE IF X>=3.5 THEN CLASS=A; 20. ||X>7.5 ||||=C; ELSE ||X>=3.5 ||||=A;
- *** A) X=7.5 B) X=3.25 A) X=7.5 B) X=3.25
- 10. IF X<=7.5 THEN CLASS=A; ELSE GO TO FIN; 10. ||X<=7.5 ||||=A; ELSE ||||FIN;
- *** 30. GO TO STP; 30. ||||STP;
- *** 40. FIN: CLASS=B; 40. FIN: ||=B;
- *** 50. STP: STOP; 50. STP: ||;
- *** 20. IF X<3.5 THEN CLASS=C; 20. ||X<3.5 ||||=C;
- *** A) X=3.25 B) X=9.5 C) X=4.5 A) X=3.25 B) X=9.5 C) X=4.5
- *** 10. FLAG=2; 10. FLAG=2;
- xxx 20. PUT LIST(FLAG, 'BEFORE');
 20. ||||(FLAG, '||');
- 30. IF A>B THEN IF C>D THEN FLAG=1; ELSE FLAG=0; 30. ||A>B ||||C>D ||FLAG=1; ELSE FLAG=0;
- *** 40. FUT LIST(FLAG, 'AFTER');
 40. ||||(FLAG, '||');
- - *** THAT IS THE END OF EXERCISE 7. I HOPE YOU HAVE FOUND IT BOTH USEFUL AND
 - INTERESTING. YOUR SCORE WAS OUT OF A POSSIBLE 25 INTERESTING. ||SCORE ||||||A POSSIBLE 25
- THIS IS EXCELLENT GOOD AVERAGE POOR TERRIBLE AND YOU SHOULD PROCEED TO
 - *** THE NEXT SECTION OF THE PI TEXT EXAMINE THE CORRECT ANSWERS AND RESIT

- |||||SECTION ||||PI TEXT EXAMINE ||CORRECT ANSWERS ||RESIT
- THE TEST RE-READ THE PREVIOUS SECTION AND RESIT THE TEST
- EXERCISE 8.
- THIS IS THE LAST EXERCISE AND TESTS YOUR KNOWLEDGE OF CHARACTER DATA
- AND THE DO STATEMENT. AS IN EXERCISE 7 YOU WILL ONLY BE ALLOWED ONE
- ATTEMPT AT ANSWERING EACH QUESTION.
 ATTEMPT ||ANSWERING ||QUESTION.
- THERE ARE MANY VARIATIONS ON THE BASIC DO STATEMENT. CONSIDER THE
- FOLLOWING STATEMENTS. IF THE STATEMENT CONTAINS AN ERROR THEM TYPE IN FOLLOWING STATEMENTS. ||||STATEMENT CONTAINS ||ERROR ||TYPE ||

- BE EXECUTED.
- *** A) DO X = 1 TO 100 BY 3 WHILE X < 70 A) ||X = 1 ||100 ||3 ||X < 70
- B) DO N = 1 TO 69 BY 2
 B) ||N = 1 ||69 ||2
- C) DO COUNT = 0 TO 15 BY 5 C) ||COUNT = 0 ||15 ||5
- The second representation of the second repre
- *** THROUGHOUT....
- *** E) DO Y=1,3*Y,5,7+Y,3*(Y+4),20
 E) ||Y=1,3*Y,5,7+Y,3*(Y+4),20
 - *** F) DO I=20101 BY -5 F) ||I=20||1 ||-5
 - G) DO K=1,3,5,A+B, HERE A=3,B=2..... G) ||K=1,3,5,A+B, ||A=3,B=2.....
- *** NOW TYPE IN YOUR ANSWER. WHAT DO YOU THINK THE ANSWER IS?
 - *** PLEASE REPLY WITH YOUR SOLUTION. WHAT'S YOUR ANSWER?

- NO THE STATEMENT IS INVALID THERE SHOULD BE BRACKETS ROUND X < 70 | |- ||STATEMENT ||INVALID ||||||BRACKETS ||X < 70
- WHAT YOU SHOULD HAVE HAD IS THERE SHOULD BE SPACES ROUND TO
- WRONG I'M SORRY THIS IS WRONG THIS IS INCORRECT
- STUDY THE FOLLOWING STATEMENTS. THEY ARE THE FIRST 10 STATEMENTS OF A STUDY ||FOLLOWING STATEMENTS. |||||||||| STATEMENTS ||A
- LARGER PROGRAM YOU WILL BE ASKED SOME DETAILED QUESTIONS ABOUT THE

- *** 10. DCL MSG(5) CHAR(50), TAB(10,2); 10. DCL MSG(5) CHAR(50), TAB(10,2);
- 20. DCL ANS CHAR; 20. DCL ANS CHAR;
- *** 30. GET LIST(BRTHYR);
 30. ||||(BRTHYR);
- *** NO. ')
- 45. READ INTO(ANS); 45. |||(ANS);
- - 60. DO INT=1 TO 100 WHILE(BRTHYR<INT); 60. ||INT=1 ||100 ||(BRTHYR<INT);
 - 70. GET LIST(DYSWRKD);
 70. ||||(DYSWRKD);
- *** 80. TAB(I,1)=365-DYSWRKD; 80. TAB(I,1)=365-DYSWRKD;
 - *** 90. PRECAL: WK=100-BRTHYR;

- 90. PRECAL: WK=100-BRTHYR;
- *** 100.ETC. 100.ETC.
- THIS STATEMENT IS PERFECTLY VALID; TRY AGAIN.
- THE NUMBER OF CHARACTERS HAS NOT BEEN SPECIFIED.
- E.G. 20. DCL ANS CHAR....
- WHAT YOU SHOULD HAVE HAD IS
- C) TYPE IN THE NUMBER OF THE NEXT STATEMENT WHICH CONTAINS AN ERROR.

- IDENTIFIES THE ERROR? C PRECAL IS IN A PROTECTED AREA IDENTIFIES || JERROR? C PRECAL || || A PROTECTED AREA
- A THE LABEL NAME IS ILLEGAL B THE FORMAT IS ILLEGAL A ||LABEL ||||ILLEGAL B ||FORMAT ||ILLEGAL
- 'PRECAL' IS INSIDE A DO LOOP
 'PRECAL' || INSIDE A || LOOP
- *** F) THE OTHER ERROR INVOLVES MISSING QUOTES. AROUND WHICH WORD SHOULD F) |||||ERROR INVOLVES MISSING QUOTES. |||||||
- *** THEY BE?
- *** THE VARIABLE NAME IS TOO LONG
 - *** I) STATEMENT 80 ALSO CONTAINS DYSWRKD, BUT ARE THERE ANY ERRORS IN THE

I) STATEMENT 80 ||CONTAINS DYSWRKD, ||||||||||||RRORS ||||

- REMAINDER OF THE SAMPLE PROGRAM?
- THAT IS THE END OF EXERCISE 8 AND ALSO THE COURSE. I HOPE IT HAS PROVED
- *** SUCCESSFUL. YOUR SCORE WAS OUT OF A POSSIBLE 16 SUCCESSFUL. ||SCORE ||||||A POSSIBLE 16
- *** THIS IS EXCELLENT GOOD AVERAGE POOR TERRIBLE AND YOU SHOULD BE WELL | | | | | | | | | | | | |
- SATISFIED WITH YOUR PROGRESS. EXAMINE THE CORRECT ANSWERS AND RESIT THE SATISFIED ||||PROGRESS. EXAMINE ||CORRECT ANSWERS ||RESIT ||
- TEST. RE-READ THE PREVIOUS SECTION AND RESIT THE TEST. TEST. RE-III PREVIOUS SECTION | RESIT | TEST.

DATABASE COMPRESSION PERFORMANCE STATISTICS

PROGRAM ANALYSIS:	QUADRATIC CONSTANT (R)	8
	MAX. WORD LENGTH	6
	TABLE SIZE (NO. ENTRIES)	631
INPUT ANALYSIS:	NO. CARDS READ	444
	TOTAL TEXT BYTES	22331
WORD ANALYSIS:	NO. WORDS ENCOUNTERED	3958
	AVERAGE LENGTH	4.131
	NO. WORDS FOUND IN DICTAB	2268
OUTPUT ANALYSIS:	TOTAL BYTES GENERATED	17205
	STORAGE REDUCTION (BYTES)	5126
	COMPRESSION FACTOR (%)	22.954

CAT RESEARCH (SCHOOL SYSTEM)

DATABASE COMPRESSION VIA REPLACEMENT OF COMMON TEXT WORDS.

ORIGINAL AND COMPRESSED CHARACTER STRINGS

- *** COMPUTER POWER TRAINING SCHOOL 28/09/76 COMPUTER ||TRAINING ||28/09/76
- CPS SELF TUITION SYSTEM VERSION: CAI/ML/04
 CPS SELF TUITION | VERSION: CAI/ML/04

- EXCEED 15 CHARACTERS FOR EITHER. NAME? LOCATION?
 EXCEED 15 CHARACTERS | | | | . | | | LOCATION?
- THAT YOU HAVE USED THE SYSTEM? PLEASE ANSWER YES OR NO.
- *** PLEASE RE-TYPE YOUR IDENTIFICATION AS IT SHOULD BE. PLEASE RE-TYPE ||IDENTIFICATION |||||||.
- YYY YOU REALLY NEEDN'T WORRY BECAUSE EVERYTHING IS FAIRLY STRAIGHTFORWARD ITTINEEDN'T WORRY BECAUSE EVERYTHING | FAIRLY STRAIGHTFORWARD
- AND IF YOU FOLLOW THE INSTRUCTIONS RELAYED BACK TO YOU BY THE SYSTEM
- YOU SHOULDN'T GO FAR WRONG.
- *** YOUR PI TEXT OR AN EXPERIENCED USER.
 - *** IF AN ERROR OCCURS WITHIN THE SYSTEM ITSELF, IT WILL TRY TO 'RECOVER'
- - *** ACCORDING TO MY RECORDS THE LAST EXERCISE THAT YOU ATTEMPTED WAS

- EXERCISE NO. YOUR SCORE WAS EXERCISE || . ||SCORE ||
- UNFORTUNATELY ALL RECORD OF YOUR PROGRESS WAS DESTROYED.
- I'M AFRAID THAT THIS ISN'T GOOD ENOUGH FOR YOU TO PROCEED AND THEREFORE
- YOU MUST RESIT THE EXERCISE.

- *** EACH EXERCISE.
- *** THIS MEANS THAT YOU HAVE ACHIEVED A SATISFACTORY STANDARD ON THE
- *** THE RESULT THAT YOU HAVE JUST OBTAINED HAS BEEN ENTERED ON YOUR SYSTEM
- *** RECORD. RECORD.
- *** TRIED WAS NO.
- *** THERE WILL BE A SHORT DELAY PLEASE BE PATIENT. THANK YOU.

 - *** TYPE IN THE EXERCISE NO. ONLY.
 TYPE | | | | | EXERCISE | | . | | .
- - *** PLEASE TYPE YES OR NO ONLY.

PLEASE TYPE !!!!!!!.

- *** SHOULD SIT IS NO. THIS IS BECAUSE YOU DID NOT GET A SATISFACTORY MARK
- *** ON THE LAST EXERCISE.
- *** IF YOU HAVE ALREADY READ THE NEXT SECTION OF THE P.I. TEXT YOU MAY
- DO YOU WISH TO DO THIS? ANSWER YES OR NO.

- HEAR FROM YOU. PLEASE ADDRESS ANY CORRESPONDENCE TO:-
- MIKE LITTLE COMPUTER POWER LTD. WALSALL ROAD CANNOCK MIKE ||COMPUTER ||LTD. WALSALL ||CANNOCK

DATABASE COMPRESSION PERFORMANCE STATISTICS

PROGRAM ANALYSIS:	QUADRATIC CONSTANT (R)	8
	MAX. WORD LENGTH	6
	TABLE SIZE (NO. ENTRIES)	631
INPUT ANALYSIS:	NO. CARDS READ	50
	TOTAL TEXT BYTES	2605
WORD ANALYSIS:	NO. WORDS ENCOUNTERED	463
	AVERAGE LENGTH	4.434
	NO. WORDS FOUND IN DICTAB	312
OUTPUT ANALYSIS:	TOTAL BYTES GENERATED	1891
	STORAGE REDUCTION (BYTES)	714
	COMPRESSION FACTOR (%)	27.408

The following notes give a brief outline of the work done in evaluating text compression via the encoded replacement of Common character strings.

(a) Identification of Common Strings

As no publication could be found which listed commonly-occuring character strings, a generator had to be produced to carry out this analysis.

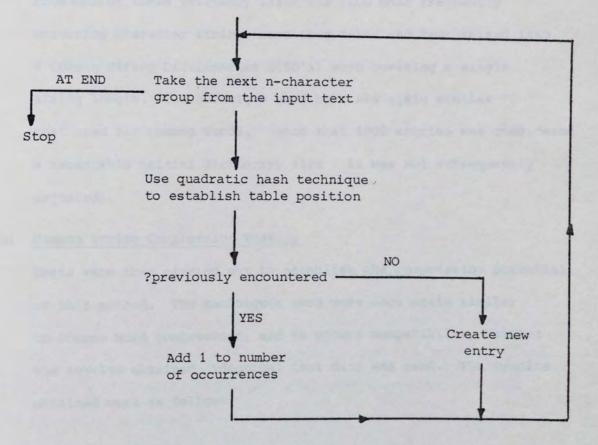
Approximately 10,000 words of source data were obtained from a variety of sources, as the following table shows:

CATEGORY	SOURCE (S)	VOLUME	8
Newspaper editorial	Sunday Times	1,500	15
Newspaper news/sport	Daily Mail Daily Mirror	} 1,500	15
Modern fiction	The Dogs of War - Frederick Forsyth .	1,500	15
Technical manual	System 370: Principles of Operation (IBM)	1,500	15
	Lotus Elan Workshop Manual	3	
Business correspondence	Various internal Compower/ NCB correspondence	500	5
Advertising	Various Sources: mostly magazines and newspapers	500	5
Popular technical magazines	CAR; Amateur Photographer; Hi-Fi News; Car & Car Conversions	1,000	10
Religious	New English Bible	500	5
Personal correspondence	Various personal letters	500	5

CATEGORY	SOURCE(S)	VOLUME	%
Miscellaneous	Labels; Instructions;	}	
	Children's books; Circulars;	1,000	10
	Bills; LP sleeves; Official	{	10
	forms.	}	

N.B. The percentage breakdown across categories is similar to that used by Dewey(35).

From this data various Frequency Tables were evaluated, using different string lengths. The technique used to produce these was a direct development of the quadratic hash method used for Common Words (see Chapter 4, Section 4.3.4.2):



N.B. To allow for all combinations of n characters, where n=3,4,5, or 6, can require enormous dictionary tables (for instance there are 11,881,376 combinations of 5 alphabetic characters). Much smaller table sizes were

therefore employed, without producing any 'table-full' problems, as the following list shows:

n	Max. number of combinations	Actual table size used
3	17,576 (26³)	8,000
4	456,976	10,000
5	11,881,376	15,000
6	308,915,776	18,000

(where each table entry consists of the n-character sequence and the total number of occurrences).

From each of these frequency lists the 1000 most frequently occurring character strings were then taken and reorganised into 4 Common String Dictionaries (CSD's) each covering a single string length. The technique used here was again similar to that used for Common Words. (Note that 1000 entries was considered a reasonable initial dictionary size - it was not subsequently asjusted).

(b) Common String Compression Testing

Tests were then carried out to establish the compression potential of this method. The techniques used were once again similar to Common Word compression, and to ensure compatibility between the results obtained, identical test data was used. The results obtained were as follows:

CSD string length		Dictionary size (entries)	Compression factor (%)	
			Full text	Intro. text.
Fixed:	3	1000	7.411	10.309
	4	1000	9.782	13.071
	5	1000	12.067	15.350
	6	1000	12.586	16.007
Variable	e:		- Marie	
3 to 6 inclus		4000	16.114	19.839

The procedure employed for variable-length CSD's was slightly different from normal in that a compound table of 4000 entries was used, but this was treated as 4 separate fixed-length subtables. Character strings of length 6 were searched for first, then length 5 etc. The 2-byte compression code was also modified to use the first two bits to indicate which subtable had identified the common string:

00 - subtable, length 6
01 - " " 5
10 - " 4
11 - " 3

Whereas this compound CSD will contain most, if not all Common Words of ≤ 6 characters, plus common strings, the ability of the Common Word method to delete a space character after any word represents a significant extra factor. Also a comprehensive CSD tends to be very large in comparison to a Common Word Dictionary (CWD) and the compression processing is much slower (in these tests by a ratio of approximately 14:1). Whilst the above results could possibly be improved somewhat, it is unlikely that they could approach the overall efficiency of the Common Word technique.

* APPENDIX 5.1 - SCHOOL Subsystem/Module cross-reference

Subsystem:

SYSTEM MANAGER	SCS	ACS	TLCS
*CYBER	*SUPERVYS	*AUTHOR	*TUTOR
	SCSACTIV	ACSALTR	REGISTER
	SCSAUTH	ACSANAL	LOOKUP
	SCSBACK	ACSCONT	BLAKBORD
	SCSDBPR	ACSDELT	CHECKER
	SCSDBTU	ACSGLOS	PLEASIR
	SCSGMRD	ACSHIST	MARKER
	SCSGMRE	ACSMSGA	
	SCSGMRG	ACSMSGB	
	SCSGMRL	ACSMSGS	
	SCSMANGR	ACSREMV	
	SCSPASS	ACSSTUD	
	SCSREORG	the state of the s	
	SCSREST	A STATE OF THE STA	
	SCSSCRD		
	SCSSTUD		
	SCSSUBJ		
	SCSSUBRF		
	SCSSYSBS		
	SCSTIME		
	SCSVERSN		

N.B. '*' indicates the Subsystem Control Module.

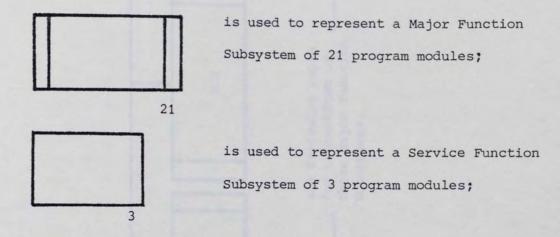
Subsystem:

DIS	KRES	ICES	DFS
*CREATOR	*MONITOR	(Control module	*SCREEN
BUILDFDB		function handled	BREAKFDB
COMPRESS		within MONITOR)	EXPAND
FORMSDEF			
FORMLDEF FORMLAR		ICABAND	
		ICANS	
FORMSMR		ICCOMM	
FORMGDR		ICDETAIL	
FORMQDEF		ICHINT	
FORMHINT		ICMSGS	
FORMADEF		ICREPEAT	
FORMCOMM		ICRESUME	
FORMSYN		ICSUSPND	
		ICGLOSS	
		ICANAL	
		ICHIST	
DIOS	EMS		
*MANAGER	*ERROR		
READER			
WRITER			

N.B. '*' indicates the Subsystem Control Module.

APPENDIX 5.2 - Software structure charts.

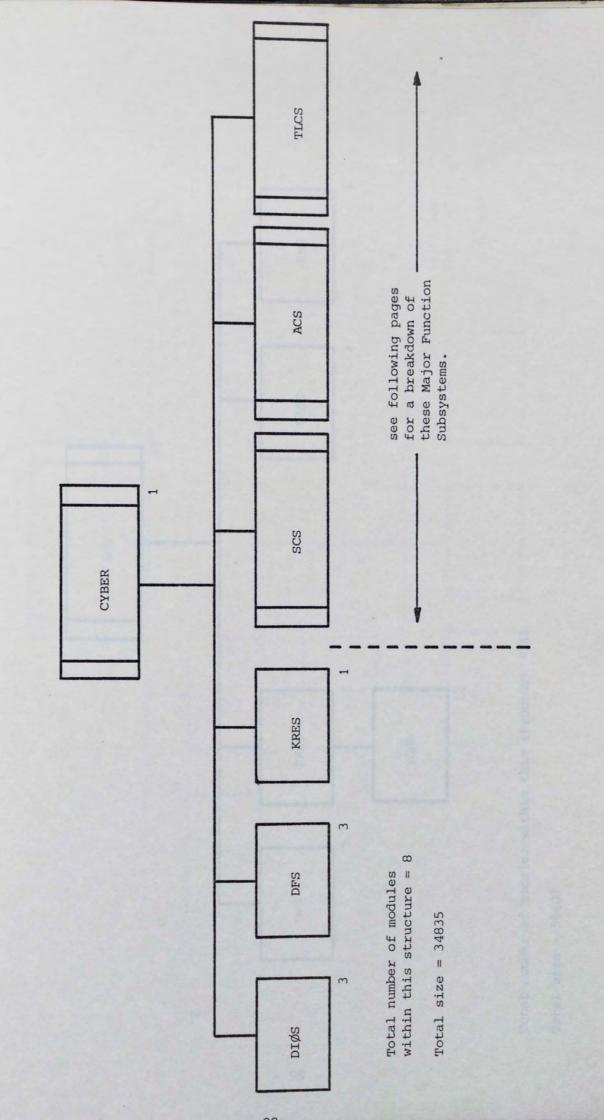
This appendix contains a number of diagrams which illustrate the inter-relationships of Major Function and Service Function Subsystems.



Statistics are included within each diagram to define:

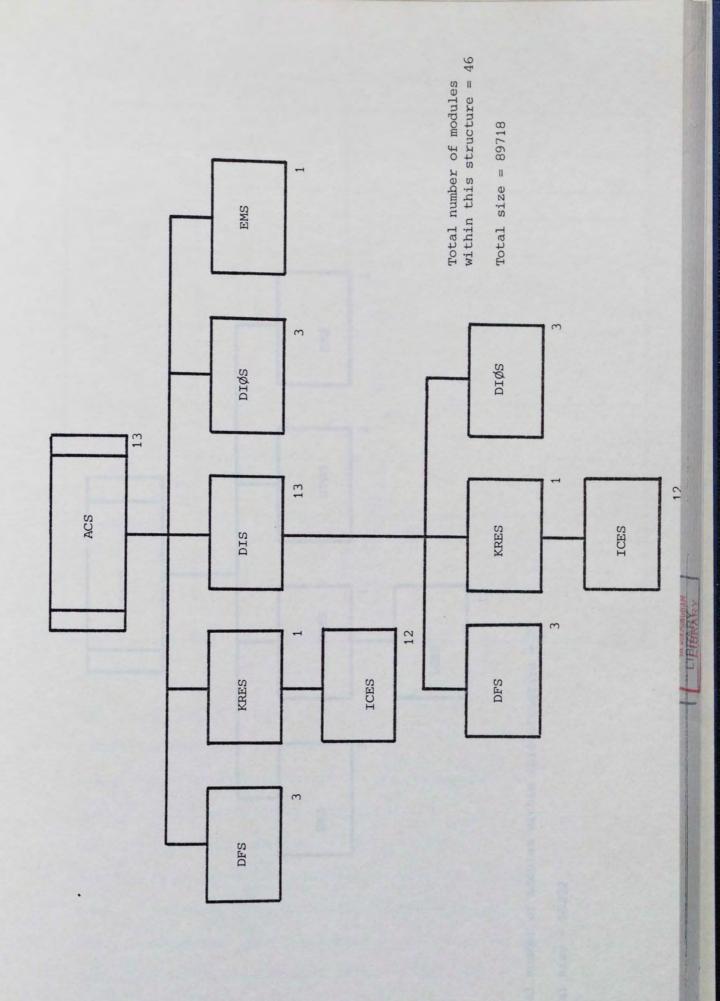
- (i) the total number of program modules within the illustrated segment of the SCHOOL system;
- (ii) the total size (in bytes) of the illustrated segment, including any associated Data Nuclei.

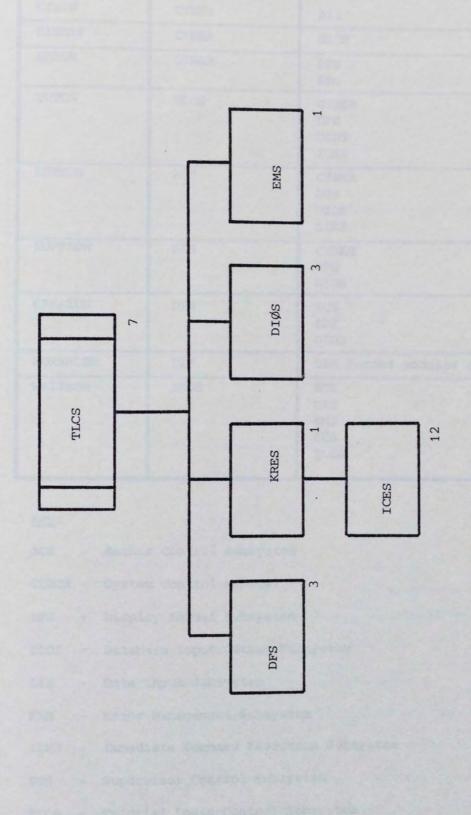
These statistics can be used to estimate that proportion of the SCHOOL software which needs to be active at any one time to handle the processing of a particular user type.



Total number of modules within this structure = 41

Total size = 59407





Total number of modules within this structure = 27

Total size = 56292

APPENDIX 5.3 - Data Nucleus/Subsystem cross-reference

DATA NUCLEUS	OWNER SUBSYSTEM	USER SUBSYSTEM(S)	
CYBDN	CYBER	All	
BITMAP	CYBER	DIOS	
ERRDN	CYBER	DFS EMS	
TUTDN	TLCS	CYBER DFS DIOS ICES	
AUTHDN	ACS	CYBER DES DIOS ICES	
SUPERDN	SCS	CYBER DFS DIOS	
CREATON	DIS	ACS DFS DIOS	
FORMATON	DIS	DIS Format modules only	
WRITEDN	DIOS	ACS DIS EMS SCS TLCS	

Key:

ACS - Author Control Subsystem

CYBER - System Control Manager

DFS - Display Format Subsystem

DIOS - Database Input/Output Subsystem

DIS - Data Input Subsystem

EMS - Error Management Subsystem

ICES - Immediate Command Execution Subsystem

SCS - Supervisor Control Subsystem

TLCS - Tutorial Logic Control Subsystem

To remove a student registration from the SCHOOL Database a sequence similar to the example below is required:

- N.B: a) All 3 identification parameters must match the D/B entry for removal to be effected;
 - b) Specifying a Student Id. in the form:

*nnn (where nnn is a numeric integer) will result in a list of students who have not been active within the last nnn calendar days being returned. The Author may then REMOVE all or selected members from this list.

ACS Module	Supported command
ACSALTR	ALTER
ACSANAL	ANALYSIS
ACSCØNT	CØNTENTS
ACSDELT	DELETE
ACSGLØS	GLØSSARY
ACSHIST	HISTØRY
ACSMSGA	MSGALTER
ACSMSGB	MSGBUILD
ACSMSGS	MSGSCRUB
ACSREMV	REMØVE .
ACSSTUD	STUDENTS
	(DESCRIBE
	(END
AUTHOR	(MSGSHØW
	((RESETLAR
links into)	
Data Input)	CREATE
Subsystem)	Cidenta
(DIS)	

This Appendix contains some extracts from the SCHOOL Author Manual.

Two main sections are included:

- i) a general overview of Course Creation Procedure;
- ii) details of Author Document completion.

The text taken from the Author Manual has been photo-reduced for inclusion here - it should also be noted that the SCHOOL Author Manual is normally duplicated on both sides of the paper. This has not been done here.

CHAPTER 3 - SCHOOL COURSE CREATION PROCEDURE

3.1 OVERVIEW

The full sequence of operations required when designing and creating a SCHOOL Course has already been illustrated in Fig. 1.2

The Author's involvement is as follows:-

- a) become familiar with the relevant subject matter;
- define the structure of the Course;
- c) code the Course on SCHOOL Author Documents;
- d) enter the Course (interactively or automatically) into the SCHOOL system;
- e) run through the Course interactively as a student;
- f) correct any errors encountered during(e);
- g) release the Course for general use;
- h) monitor the performance of the students and the Course itself and carry out any necessary adjustments.

Only steps (a) to (d) will be discussed within this Chapter, steps (e) to (h) being covered in considerable detail in later Chapters.

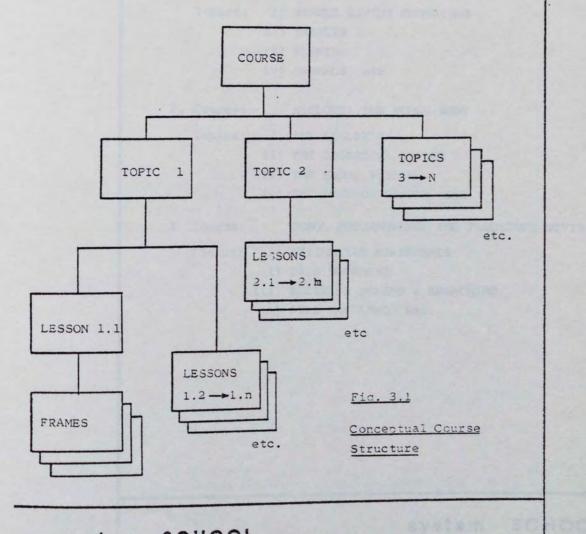
3.2 SUBJECT MATTER FAMILIARISATION

This is entirely independent of the SCHOOL System itself and is the responsibility of each individual Course Author. It is important however to stress that a reasonable level of subject knowledge be obtained prior to authoring a SCHOOL Course, in order to ensure a concise and logical Course structure.

3.3 COURSE STRUCTURE

As with any conventional form of education, SCHOOL Courses are only viable if they are designed within the framework of a Course Structure. The criteria imposed by SCHOOL are however limited, and the Author retains a considerable amount of design flexibility, as will become apparent in the following notes.

System SCHOOL looks on any Course as a progressively subordinate, or hierarchical, structure of instructional units, as Fig 3.1 below illustrates:



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The functional characteristics of the units in the above diagram are as follows:-

- a) Course an entirely separate subject (e.g. Biology, COBOL programming, Management Accounting, Computer Operating) or a major part of a larger subject (e.g. Biology: The Human Body, COBOL programming: The Procedure Division etc).
- b) <u>Topic</u> an independent Course subject consisting of one or more subordinate lessons. The exact scope of a Topic depends on the scope of the Course to which it is subordinate.

Examples:

1. Course: BIOLOGY

Topics: i) SIMPLE LIVING ORGANISMS

ii) INSECTS

iii) PLANTS

iv) MAMMALS etc.

2. Course: BIOLOGY: THE HUMAN BODY

Topics: i) THE SKELETON

ii) THE DIGESTIVE SYSTEM

iii) THE BLOOD SYSTEM

iv) THE NERVOUS SYSTEM etc.

3. Course: COBOL PROGRAMMING: THE PROCEDURE DIVISION

Topics: i) ARITHMETIC STATEMENTS

ii) DATA MOVEMENT

iii) DECISION MAKING & BRANCHING

iv) FILE HANDLING etc.

c) Lesson(s)

a series of instructional
'building blocks' covering all
required aspects of topic to which
the lessons are subordinate.
Each lesson is subdivided into a
series of instructional Frames
which are covered in a logical
progression.

Examples:

1. Course: BIOLOGY

Topic: SIMPLE LIVING ORGANISMS Lessons: i) AMOEBA - CELL STRUCTURE

ii) AMOEBA - DIGESTION

iii) AMOEBA - REPRODUCTION

iv) HYDRA - STRUCTURE etc.

2. Course: BIOLOGY: THE HUMAN BODY

Topic: THE SKELETON

Lessons: i) THE SPINE

ii) THE RIB CAGE

iii) THE ARM

iv) THE LEG etc.

3. Course: COBOL PROGRAMMING:

THE PROCEDURE DIVISION

Topic: ARITHMETIC STATEMENTS

Lessons: i) ADD

ii) SUBTRACT

iii) MULTIPLY

LII) MODILIFEI

iv) DIVIDE etc.

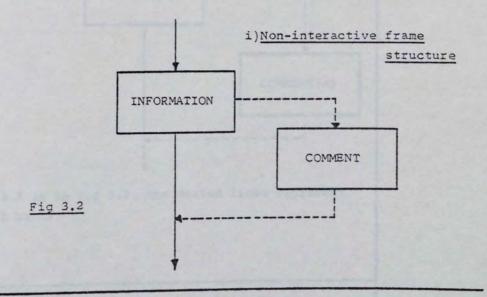
- d) Frame(s)
- a series of inter-related instructional components. These are delivered to the student in a sequence, which taken in total coversall desired aspects of the associated lesson.

Frames can be considered as being of 2 types.

- i) Non-interactive gives information or instruction only. The student is not required to formulate and supply an answer of any kind (e.g. descriptions, worked examples, theorems, lists etc.)
- ii) Interactive
- optionally gives some information, then asks an appropriate question about this or some other associated information. The student then has to produce and supply an answer, which can be a variety of forms, depending on the question.

 Answers may not however exceed one line in length.

Within these 2 types of Frame there are markedly different Frame structures, consisting of one or more parts (corresponding directly to SCHOOL Database components):

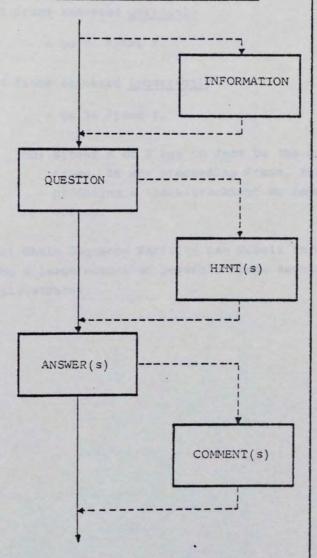


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In Fig 3.2, the dotted line indicates an optional event, i.e. after the student has absorbed the information delivered to him and signalled this (e.g. by pressing ENTER), the Author may, at his discretion, arrange for a Comment of some sort to be displayed.

Fig 3.3

ii) Interactive frame structure



In Fig 3.3 as in Fig 3.2, the dotted lines represent optional paths.

A further important consideration at this preliminary design phase is the delivery order of the Frame Sequence within a lesson. This is termed the Frame Sequence or Tutorial Chain Sequence (TCS). When the current frame is complete the Author has the option of two frames to which the student can be directed:-

- i) Current frame answered correctly
 - go to Frame X.
- ii) Current frame answered incorrectly
 - go to Frame Y.

NB: Either X or Y may in fact be the current Frame, or any preceeding Frame, thereby producing a 'back-tracking' or repetition effect.

This tutorial Chain Sequence facility can result in one lesson having a large number of possible frame sequences, as Fig 3.4 illustrates:

The sample lesson structure shown in Fig 3.4 although relatively simple to produce from the SCHOOL Authoring standpoint, gives a total of 10 unique frame sequences varying in length from 5 frames to 9.

3.4 SCHOOL AUTHOR DOCUMENT CODING

Having completed the preliminary Course Structure design, the Author now moves on to code his new Course on SCHOOL Author Documents. There are 8 types:

- a) SUBJECT DEFINITION (SDEF)
 - names new subject or identifies existing subject being extended.
- b) LESSON DEFINITION (LDEF)
 - identifies new lesson and its profile.
- c) QUESTION DEFINITION (QDEF)
 - defines information and/or question part(s) of frames within lesson, plus associated control information.
- d) HINT INFORMATION (HINF)
 - defines hint(s) to be available within a frame.
- e) ANSWER: DEFINITION (ADEF)
 - defines 'acceptable' and 'expected but non-acceptable' answer strings plus other control information.
- f) COMMENT DEFINITION (CDEF)
 - defines comments to be associated with particular defined answers.

system SCHOOL

- g) GLOSSARY DEFINITION (GDEF)
 - defines words/phrases and descriptions to be inserted into the Lesson Glossary.
- h) SYNTAX INFORMATION (SINF)
 - identifies syntax processing to be carried out on all student replies prior to answer comparison. Applicable to all frames within this lesson.

Note that there is no specific 'Topic definition' document. Instead the Author should use a series of related Lesson Definitions to create an imaginary topic grouping.

The sequence in which these documents should be used is as per Fig 3.5:

Fig 3.5: Author Document sequence

LDEF
GDEF (optional)
SINF (optional)

QDEF
HINF(optional)
ADEF
CDEF(optional)
repeat for n
frames within
lesson.

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It is not necessary to create a subject in its entirety within one batch of Author Documents. In fact it is possibly preferable to create only a few lessons or frames at a time, test them as a student (and carry out whatever alterations seem necessary) and then create the next part of the subject and so on.

Furthermore SCHOOL provides a great deal of flexibility in the order of individual Author Documents with a batch. The only rules which must be followed are:-

- i) The first document in the batch must be SDEF.

 If omitted, an error will occur, the exact
 nature of which depends on the Course Input Mode
 being employed this point will be clarified in
 section 3.5
- ii) When an LDEF document is encountered, this effectively terminates any previous lesson and starts a new one the <u>current lesson</u>.
- iii) Any GDEF or SINF Document encountered will be assumed to be associated with the lesson no. defined on the document itself, or if omitted, the current lesson.
 - iv) Any frame component being created (QDEF, HINF, ADEF or CDEF) will be assumed to be associated with the frame (i.e. question) no. defined on the document itself (see document formats), and to be part of the <u>current lesson</u>, as designated by the most recent LDEF.

3.4.1 Author Document Coding Rules

As with any computer input document, a series of rules must be adhered to when completing SCHOOL Author Documents.

Firstly, as dictated by the currently available terminals (as at November 1978) only upper-case letters should be used, and care should be taken in the way that they are written:

ABCDEFGHIJKLMNOPQRSTUVWXYZ

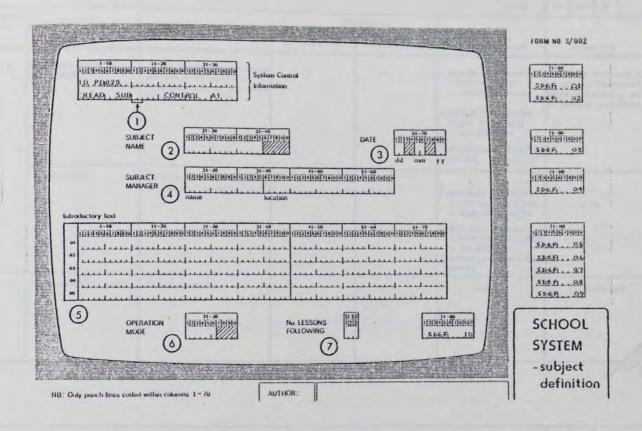
Numbers should be written as

1234567890

Special characters as found on the standard Data Entry and Typewriter terminal keyboards may also be used quite freely, although care should be taken in the way *(asterisk) is employed, as will become apparent when studying Author Document entry values (e.g. *NULL, *ALL) later in this subsection, and the Immediate Command facility (Chapter 6).

Complete details of Author Document Structure and the rules for completion follow:-

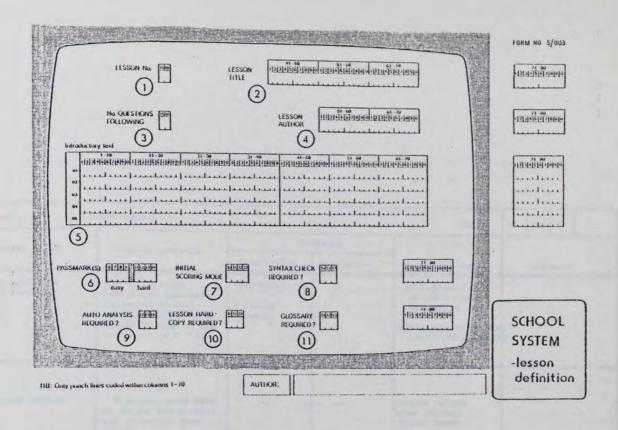
(Note that the circled labels are for purposes of explanation only, and do not normally appear on Author documents).



DOCUMENT		UBJECT DEFINITION			PAGE	1 OF 3
Label	Field Title	Correct contents	DE	FAULTS		
	rield little	Correct contents	Interactive	Automatic	Error Messages	Comments
1.	SUBJECT REFERENCE NO.	Ref.no. as allocated by System Supervisor. Must be unique.			A)NON-NUMERIC SUBJECT REF. NO.	Always required
					D)NON-RECOVERABLE ERROR:AUTHOR DOCUMENT FILE NOT FOUND-PROCESS ABENDED.	
2.	SUBJECT NAME	& 15-character unique subject name			A)SUBJECT NAME XXXXXXXXX ALREADY ALLOCATED - ENTER A DIFFERENT NAME.	Always required
					- new subject b)SUBJECT NAME NOT FOUND - old subject	
3.	DATE	Date of creation / extension.	current date	current date	NONE (not validified)	Not requested in interactive mode

abel								3	
No.	Field Title	Correct contents	DE	FAULTS					
			Interactive Automatic		Error Messages	Comments			
4.	SUBJECT MANAGER - NAME	4 15-character name of person with overall responsibility for this subject.			a)SUBJECT MANAGER NAME OMITTED - PLEASE ENTER: b)SUBJECT MANAGER NAME INCORRECT - RE-ENTER: (extension security check)	secur when alter	rity	purp	
	- LOCATION	4 25-character location of subject manager			a)SUBJECT MANAGER LOCATION OMITTED - PLEASE ENTER: b)SUBJECT MANAGER LOCATION INCORRECT		as 4	1.	
		10			- RE-ENTER: (extension security check).				
5.	INTRODUCTORY TEXT	As appropriate '			NONE	May 1	ре од	itte	d
									1

DOG	CUMENT	SUBJECT DEFINITION			PAGE	3	OF	3
Label	Field Title		DEI	FAULTS				
NO.	Field Title	Correct contents	Interactive	Automatic	Error Messages		Comm	ents
6.	OPERATION MODE	CREATE EXTEND	*NOT REQUESTED 'CREATE'always assumed.	-	ILLEGAL OPERATION MODE 'XXXXXX' DEFINED - ENTER REQUIRED MODE.			s for detai utilisation
7.	NO. LESSONS FOLLOWING	The no. lessons following as identified by seperate Lesson Definition documents in this batch of Author data. Should be numeric and in the range 0 - 40.	*NOT REQUESTED O always assumed	o	a)NON-NUMERIC NO.LESSONS b)TOO MANY LESSONS SPECIFIED c)CONFLICT BETWEEN DEFINED NO. LESSONS AND ACTUAL.	- ri (on: les:	in in te	quested rminated fined no. efinitions d).
								-\si\text{3}



DO	CUMENT	LESSON DEFINITION	PAGE	1	OF	4		
Labe1			DE	FAULTS				
No.	Field Title	Correct contents	Interactive	Automatic	Error Messages		ents	
1.	LESSON NO.	Number of lesson being created or extended, Must be numeric and in the range 1 - 40.		-	a)INVALID LESSON NORE-ENTER b)LESSON QUOTA FOR SUBJECT FILLED- LESSON CREATION IMPOSSIBLE	a w	rying new	ts when g to create lesson n an alread subject.
2.	LESSON TITLE	\$30-character lesson title. This field may be used to define a lesson password (4 characters between brackets). If no password is specified a 'null' entry is assumed. If a lesson password is defined, it will be requested and must be supplied in order to amend or extend the lesson structure at any stage in the future.			a)INVALID LESSON TITLE - RE-ENTER b)LESSON TITLE OMITTED-RE-ENTER	omit		but passwor

DOC	UMENT	LESSON DEFINITION			PAGE	2	OF	4	
Label	Field Title	Correct contents	DEFAULTS						
		- Contents	Interactive	Automatic	Error Messages	Comments			
3.	NO QUESTIONS FOLLOWING	The no.Question Definition documents following in this batch of Author data. Should be numeric and in the range 0 - 40.	*NOT REQUESTED O always assumed	0	a)NON-NUMERIC NO.QUESTIONS- RE-ENTER: b)TOO MANY QUESTION SPECIFIED-RE-ENTE	S R:			
4.	LESSON AUTHOR	\$20-character name of person who creates and maintains this lesson			LESSON AUTHOR NAME OMITTED - PLEASE ENTER	-			
5.	INTRODUCTORY	As appropriate	-	-	None	May	be or	mitted	,
		The second second							
			Carrie Mar		THE RESERVE				ADIA!

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NOTES:

- Under all normal circumstances, students are not allowed to proceed to the next lesson until they have achieved a score the defined passmark.
- L2: Two entirely separate and parallel scoring systems are available to the Author, viz EASY and HARD. The relationships between lesson passmarks and individual question scores should be structured so that:
 - a) EASY mode designed in such a way that the passmark is around 50% of the maximum achievable score.
 - b) HARD mode designed to give a passmark of at least 80% of the maximum possible.

It is advisable to invoke EASY mode at first and should this result in all, or almost all, students achieving the lesson passmark, then the current scoring should be switched over to HARD.

DOCUMENT		LESSON DEFINITION		PAGE	3 OF 4	
Label			DE	FAULTS		
No.	Field Title	Correct contents	Interactive	Automatic	Error Messages	Comments
6.	PASSMARKS	Values chosen to be the passmark for EASY/ HARD mode of marking. Should be numeric and in the range 0 - 999, actual value depending on the no. questions in the lesson and the marks awarded for each.			a)PASSMARK ONITTED - PLEASE ENTER b)NON-NUMERIC PASSMARK-RE-ENTER c)PASSMARK EXCEEDS MAXIMUM-RE-ENTER	Passmarks of O should be used when all question frames do not involve answer checking (i.e. a purely informative lesson) *See note Ll
7.	INITIAL SCORING	EASY HARD		'EASY'	UNRECOGNISED SCORING MODE- RE-ENTER:	*See note L2

NOTES:

- L3: If YES is specified, this signifies that the Lesson is to have a Syntax Information Block associated with it. This will be defined on a following Syntax Information Document.
- L4: If YES is specified, an empty Lesson Analysis Record is automatically created for this Lesson. This will remain empty until such time as the Lesson is activated, at which point the collection of analysis data will commence.
- L5: If YES is specified, a printed copy of all executions of this Lesson will be subsequently produced, until the hard copy setting is explicitly reset.

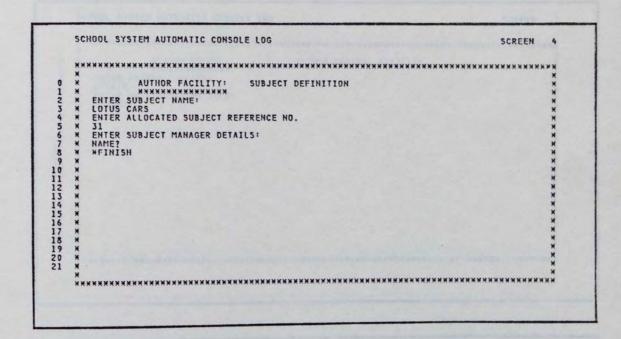
DOG	CUMENT	LESSON DEFINITION			PAGE	4	OF	4		
Label	Field Title		DEI	FAULTS						
NO.	rield little	Correct contents	Interactive	Automatic	Error Messages	Comments				
8.	SYNTAX CHECK REQUIRED	N.B. 'NO' may be followed or preceded by a blank character.	*NOT REQUESTED	1001	ANSWER YES OR NO	interest is Syn	requirer a sepation used tax is	arate commuto de: nform	and fine ation.	
9.	AUTO ANALYSIS REQUIRED	YES/NO (as above)		'YES'	ANSWER YES OR NO	*Se	e not	e L4		
10.	LESSON HARD COPY REQUIRED	YES/NO (as above)	-	1001	ANSWER YES OR NO	*se	e not	e L5		
11.	GLOSSARY REQUIRED	YES/NO (as above)	*NOT REQUESTED	'NO'	ANSWER YES OR NO				e for rmation	
									ADI LINE	

	1-10	1-26 21-	20 31-40			7	FOILM No. S/00U4
A:	IN THE PROPERTY OF THE PARTY OF	PENERINAME CONTRACTOR	तिबार्क तंत्रात्रस्ति विधानान वि	[3]4]2[6]1[6]0[1]3[4]2[6]			13141214141414
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,			····l·····l·····l·	*********		200 M	اسسسا
B:			20 21-40 [7][8][9][6][2][2][7][8][8][7][8][9][7][7]	41-60 [3]4[5]6[7] 8[9]0 1[7]2[4]5]6		750	भारतीयाँ स्ट्रान्स् भारतीयाँ स्ट्रान्स्
	a malantan					37.000 3.000	mulana
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	Chartender	لسسلسا					
C:	11334 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	11 :30 21- 6 6 2 0 0 0 1 3 4 6	(1) [1] [1] [1] [1] [1] [1] [1] [1] [1] [1]	41-60 [3]4[6[4]7[4]9]0[1]7[3]4]6[6	मिन्निकार्गार्गाम् विग्राम् कृत		ात्रजगुर्स् <u>च</u> राक्षण
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	[l						
	ASSOCIATED QUESTION N	1 11/	0		13/3/4/21/4/1		SCHOOL
1	4 Octanori	- Ш			t	12000	
1						上華	SYSTEM
	CHARLES HE RESTRICTED	Charles and the same of	THE RESERVE OF THE PARTY OF THE				-hint
100			$(x_i, y_i) \in \mathcal{F}_{i+1}$	1.00	$\mathcal{L}_{\mathbf{x}}$		informat
						and the management of	milomia

DO	CUMENT HI	NT INFORMATION			PAGE	1	OF	1	
Labe1		DEFAULTS							
No.	Field Title	Correct contents	Interactive	Automatic	Error Messages	Comments			
1.	Hint A	Required hint A text in display format.	•	null entry		mod be cre	e,*NU enter ate a this	active LL show ed to null e partic	ntr
2	Hint B	As above for hint B		null entry	-		"		
3	Hint C	As above for hint C.		null entry	-		"		
4	Associated question number	Number of an existing question with which these hints are to be associated. Must be numeric and in the range 1 - 40.	-	Current question no. (if known)	a) INVALID QUESTION NORE-ENTER: b) QUESTION NO. OMITTED AND CURRENT NOT KNOWN - ENTER: c) QUESTION SPECIFIED DOES NOT EXIST - RE-ENTER NO.	1 6	eing	ise thr	eri

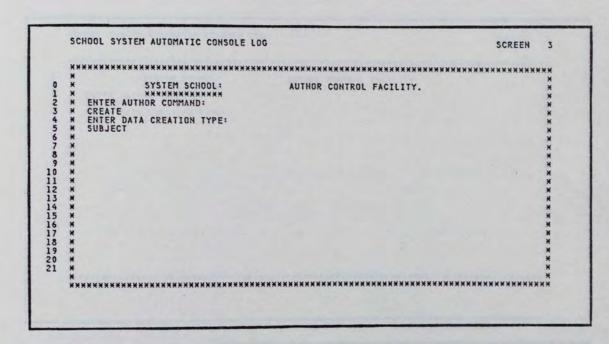
APPENDIX 7.2 - Sample courseware creation sessions.

This appendix contains a number of extracts from interactive SCHOOL Author sessions. The extracts, which are not all related to the same Subject, have been chosen to illustrate most aspects of the courseware creation repertoire. Suitable comments have been appended.



(Note the effect of the *FINISH Immediate Command. This terminates SCHOOL completely and the subject creation sequence has no effect on the database).

The following session is a re-run of the previous one, but in this instance correct data is used.

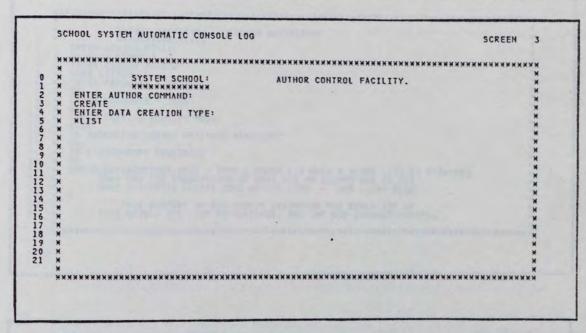


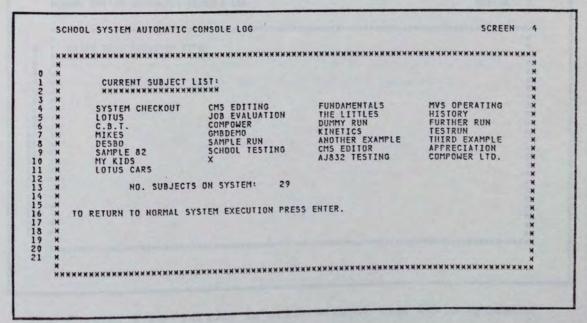
**	ИНУУНИКИЙКИКИКИКИКИКИКИКИКИКИКИКИКИКИКИКИКИК	×××
*****	AUTHOR FACILITY: SUBJECT DEFINITION WMANAWAWAWAWAWAWA ENTER SUBJECT NAME: LOTUS CARS ENTER ALLOCATED SUBJECT REFERENCE NO. 17 ENTER SUBJECT MANAGER DETAILS: NAME? MIXE LITTLE LOCATION? COMPOWER ENTER INTRODUCTORY TEXT - TYPE A COLON (:) WHEN A BLANK LINE IS REQUIRED:	****
* * * * * * * * * * * * * * * * * * * *	DEMONSTRATION SUBJECT USED TO ILLUSTRATE VARIOUS ASPECTS OF COURSEWARE CREATION, PARTICULARLY LESSON DEFINITION AND STATUS EXAMINATION.	****

L. PIBRICHY

This third session illustrates the definition (at a later stage) of a lesson subordinate to the previously created Subject.

	WW			
	*	**************************************	**************************************	
0	×		**************	*****
	×			*
2	×	COMPUTED DOLLER		*
1	×	COMPOTER POWER TRAINING SCHOOL	- CAT SYSTEM (VERSION ML/1.01)	
1 2 3 4	û		THE STATE (VERSION MEXI.UI)	
5	*			
6	*	323333 33333 33 33		*
6	*	and da	999999 999999 99	÷.
	×		2222222 222222 22	~
8 9	×	20 20 20 20 20 20	99 99 99 99	0
10	×		aa aa aa aa	× ×
11	*	क्ष वा	99 99 99 99	× ×
12	×	वार्य वार वार्य वा	aa aa aa aa	× ×
17	×	aa aa aa aa aa	33 33 33 33	2
14	¥	222222	33 33 33 33	2
15	~	2222	2222222 222222	2
10 11 12 13 14 15 16 17 18	*	aaaaaa aa aa	999999 9999999	¥
17	*			×
12	×	ENTER OPERATION MODE:-		*
10	×	AUTHOR		×
2 ń	×	ENTER PASSWORD:		×
20	*	ELANS3		*
	*	CENTISS		*
	××	******		×
		*********************	<i>********************************</i>	*****





***********	*******************************	******************	×
ENTER DATA CR	EATION TYPE:		*
3 ×			×
4 × 5 ×			*
5 × 7 ×			*
8 ×			×
X			×
1 × 2 ×			×
3 X			*
× .			×
5 * 7 *			×
3 ×			×
0			×
		**********	**

(See Chapter 9 for various tutorial uses of this Subject/Lesson

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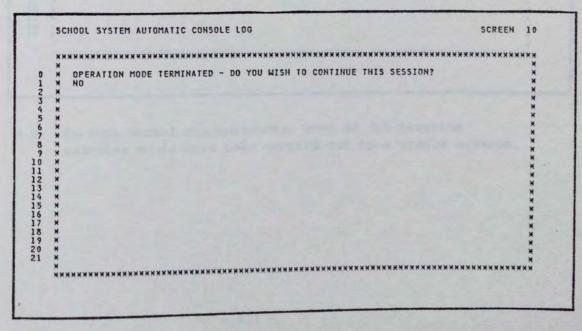
The extract below shows a (later) session to create Lesson Analysis and Glossary facilities for subject LOTUS CARS/

SCREEN 8

SYSTEM SCHOOL: AUTHOR CONTROL FACILITY.
* ENTER AUTHOR COMMAND:
* CREATE
X ENTER DATA CREATION TYPE:
* LESANAL
* ENTER SUBJECT NAME:
* LOTUS ACRS
* SUBJECT NAME NOT FOUND - REENTER:
- LUIUS CARS
ENTER LESSON NO:
* COMMAND COMPLETE: LESSON ANALYSIS RECORD CREATED * ENTER DATA CREATION TYPE:
* GLOSSARY
* COMMAND COMPLETE: CLOSSARY TIME
* END
H
X X
J *

н

×	**************************************	**************************************	******
*	SYSTEM SCHOOL:	AUTHOR CONTROL FACILITY.	*
× ENT	TER AUTHOR COMMAND:		* * * * * * * * * * * * * * * * * * *
* * * * * * * * * * * * * * * * * * *			
×			
×			
×			Ŷ.
×		and the same of the same of the same of	×
×			· ×
×			*



The following 2 screens demonstrate the procedure involved in adding a Glossary entry to the subject LOTUS CARS, Lesson 2.

N.B. In more normal circumstances, most of the previous examples would have been carried out in a single session.

The next 4 screens demonstrate a typical Frame creation sequence. In this instance this is a non-interactive frame, and as a consequence no Hint or Answer entries are defined.

/continued

SCHOOL SYSTEM AUTOMATIC CONSOLE LOG SCREEN 19 ANSWER DEFINITION SUBJECT: FIRST AID LESSON: 01/TYPES OF INJURY FRAME: 02 ENTER PRIME ANSWER: 11 12 13 14 15 16 17 18 19 20 21

SCHOOL SYSTEM AUTOMATIC CONSOLE LOG SCREEN 20 COMMENT DEFINITION SUBJECT: FIRST AID LESSON: 01/TYPES OF INJURY FRAME: 02 ENTER COMMENT: A (CORRECT ANSWER):
WE WILL NOW MOVE ON TO EXAMINE IN GREATER DETAIL THE CHARACTERISTICS
OF SUPERFICIAL AND DEEP BURNS IN TURN 67 89 10 11 12 13 14 15 16 17 18 19 20 21 ENTER COMMENT: B (CORRECT ANSWER): /ALL ******** FRAME CREATION SEQUENCE COMPLETE *********** ENTER DATA CREATION TYPE: QUESTION

The following 5-screen sequence represents a typical approach to creating a Syntax Information Block within an already defined Subject/Lesson.

			SCREEN 18
×	**************	************************************	***************************************
* *	SYSTEM SCHOOL: ************** ENTER AUTHOR FUNCTION:	AUTHOR CONTROL FACILITY.	**************************************
* *	ENTER DATA CREATION TYPE: SYNTAX ENTER SUBJECT NAME:		* * * * * * * * * * * * * * * * * * *
* * * *	SAMPLE RUN ENTER LESSON NO: 1		* * * * * * * * * * * * * * * * * * *
×			× × × ×
* * * *			* *
* * * *			* * *
×	***********************	***************************************	* ************************************

* *	AUTHOR FACILITY:	SYNTAX INFORMATION
*	==> REDUNDANT CHARACTERS:	REPLY Y OR N TO DEFINE WHICH OF THE FOLLOWING ** CHARACTERS YOU WISH TO BE REMOVED: **
*	SPACES - LEADING?	
*	Y SPACES - TRAILING?	
*	SPACES - NON-DELIMITING?	<u> </u>
* * *	Y SPACES - ALL?	
×	N COMMON PUNCTUATION?	* *
*	N LEADING ZEROES?	response a la company de la co
*	Y REDUNDANT BRACKETS?	* *
*	Y OTHER CHARACTERS? /NONE	× ×

/continued....

SCHOOL SYSTEM AUTOMATIC CONSOLE LOG SCREEN 20 ==> CHARACTER CONVERSIONS: REPLY Y OR N TO DEFINE CASE CONVERSION REQUIREMENTS: TO UPPER CASE? TO LONER CASE? CONTRADICTORY CONVERSION DEFINITIONS - RE-ENTER BOTH: 10 TO LOWER CASE? ==> CHARACTER SUBSTITUTIONS: SPECIFY CHARACTER SUBSTITUTION PAIRS OR ENTER /NONE IF YOU DO NOT REQUIRE THIS FACILITY: 13 14 15 16 17 NONE ==> STOP WORD LIST: SPECIFY WORDS TO BE REMOVED ENTIRELY FROM INPUT (/NONE TO IGNORE, /ALL AFTER LAST): 18 19 20 21 THE

APPENDIX 8.1 - Details of DFS Module SCREEN

LANGUAGE	ASSEMBLER
Program size	6929 bytes N.B. This includes 3 1760-byte screen buffers (22 lines of 80 characters)
Subordinate modules/ macros	BREAKFDB - See Appendix 8.2 DMSGIO - IBM software module for 3270 control (See Note A). PRINTL - CMS virtual printer control macro. WRTERM - CMS terminal control macro (non-3270)

NOTE A:

DMSGIO is an IBM module provided as part of the VM/370~CMS software. The parameters passed into DMSGIO are as follows:-

- (i) Buffer Address address of data to be displayed;
- (iii) Length number of bytes to be displayed:
- (iv) Cancel/Erase flag specifies whether or not screen contents (with or without input area) are erased before display.

APPENDIX 8.2 - Details of DFS Module BREAKFDB

LANGUAGE	ASSEMBLER
Program size	N.B: This includes a 1440 - byte terminal image buffer (18 * 80-byte lines - no current SCHOOL display operation exceeds this.)
Subordinate modules	EXPAND - compressed text expansion module.

APPENDIX 8.3 - Sample output from a non-3270 terminal.

This Appendix contains some sample sessions carried out on an Anderson Jacobson 832 'daisy-wheel' terminal. These extracts are included to illustrate the different device handling characteristics of the SCHOOL Display Format Subsystem DFS. Points to note are:

- (i) different SCHOOL header format;
- (ii) use of blank lines and asterisks to subdivide session (on a 3270 screen, these would represent separate screen displays);
- (iii) the ability to input and process upper and lower case text;
- (iv) session contents are similar to and may be compared with, examples used in Chapter 7 and Appendix 7.2.

****** * SYSTEM SCHOOL *

COMPUTER POWER TRAINING SCHOOL ************ CAT SYSTEM (VERSION ML/1.02)

ENTER OPERATION MODE: -

·control ENTER PASSWORD:

· abcdef PASSWORD NOT RECOGNISED

ENTER OPERATION MODE:-

•author ENTER PASSWORD:

·elans 3

SYSTEM SCHOOL: ****** AUTHOR CONTROL FACILITY.

ENTER AUTHOR COMMAND:

CURRENT SUBJECT LIST: *******

SYSTEM CHECKOUT CMS EDITING FUNDAMENTALS
LOTUS JOB EVALUATION THE LITTLES COMPOWER C.B.T. MIKES DESBO GMBDEMO KINETICS TESTRUN
SAMPLE RUN ANOTHER EXAMPLE THIRD EXAMPLE
SCHOOL TESTING CMS EDITOR APPRECIATION SAMPLE 82 MY KIDS

DUMMY RUN

MVS OPERATING HISTORY FURTHER RUN

NO. SUBJECTS ON SYSTEM: 26

TO RETURN TO NORMAL SYSTEM EXECUTION PRESS ENTER.

.*copyoff COMMAND COMPLETE: REPLY TO ORIGINAL REQUEST

·create ENTER DATA CREATION TYPE:

·glossary ENTER SUBJECT NAME:

· cms editing ENTER LESSON NO:

. 1 COMMAND COMPLETE: CLOSSARY TABLE CREATED

ENTER DATA CREATION TYPE:

·glossary GLOSSARY ALREADY CREATED - COMMAND IGNORED

ENTER DATA CREATION TYPE:

· end

SYSTEM SCHOOL: ******

AUTHOR CONTROL FACILITY.

ENTER AUTHOR COMMAND:

.end

OPERATION MODE TERMINATED - DO YOU WISH TO CONTINUE THIS SESSION?

.yes
ENTER OPERATION MODE:-

.student



* SYSTEM SCHOOL *

******* CAT SYSTEM (VERSION ML/1.02)

ENTER OPERATION MODE: -

· author ENTER PASSWORD:

•elans3

SYSTEM SCHOOL:

AUTHOR CONTROL FACILITY.

ENTER AUTHOR COMMAND:

•create
ENTER DATA CREATION TYPE:

.subject

AUTHOR FACILITY:

AUTHOR FACILITY: SUBJECT DEFINITION

ENTER SUBJECT NAME:

•aj832 testing
ENTER ALLOCATED SUBJECT REFERENCE NO.

.37 ENTER SUBJECT MANAGER DETAILS: NAME?

·mike little LOCATION?

•sys • support

ENTER INTRODUCTORY TEXT - TYPE A COLON (:) WHEN A BLANK LINE IS REQUIRED:

•:

Simple test session to illustrate operations on the

SCHOOL system using a non-3270 terminal,

in this instance an Anderson Jacobson 832a.

.:

ENTER DATA CREATION TYPE:

·lesson ENTER LESSON NO:

.1

AUTHOR FACILITY: LESSON DEFINITION ******

ENTER LESSON TITLE:

•Starting up
ENTER LESSON AUTHOR:

·mike ENTER PASSMARK - EASY:

.50 ENTER PASSMARK - HARD:

.75
ENTER INITIAL SCORING MODE:

.easy
IS AUTOMATIC LESSON ANALYSIS REQUIRED?

.yes
IS A HARD-COPY REQUIRED?

•no
ENTER INTRODUCTORY TEXT - TYPE A COLON (:) WHEN A BLANK LINE IS REQUIRED

. This is the start of instruction as to how to operate SCHOOL

· on a hard-copy device.

The terminal in question is the ANDERSON JACOBSON 832A.

ENTER DATA CREATION TYPE:

· end

SYSTEM SCHOOL: AUTHOR CONTROL FACILITY. *********

ENTER AUTHOR COMMAND:

.*list

CURRENT SUBJECT LIST: *******

SYSTEM CHECKOUT	CMS EDITING	FUNDAMENTALS	MVS OPERATING
LOTUS	JOB EVALUATION	THE LITTLES	HISTORY
C.B.T.	COMPONER	DUMMY RUN	FURTHER RUN
MIKES	GMBDEMO	KINETICS	TESTRUN
DESBO	SAMPLE RUN	ANOTHER EXAMPLE	THIRD EXAMPLE
SAMPLE 82	SCHOOL TESTING	CMS EDITOR	APPRECIATION
MY KIDS	X	AJ832 TESTING	

NO. SUBJECTS ON SYSTEM: 27

TO RETURN TO NORMAL SYSTEM EXECUTION PRESS ENTER.

· end

OPERATION MODE TERMINATED - DO YOU WISH TO CONTINUE THIS SESSION?

SYSTEM SCHOOL: SESSION TERMINATED.

R(31072);

•logoff
CONNECT= 00:10:45 VIRTCPU= 000:00•17 TOTCPU= 000:00•85
LOGOFF AT 17:58:47 GMT MONDAY 06/21/82

VM/370 ONLINE

!

Field	Size	Format	Comments
1. GENERAL STATUS INFORMATION :	-		Comments
- Lesson number			
- Active mode	1	binary	
- Active passmark	1	character	'E' or 'H'
- Number of frames	2	packed	
- Current frame number	1	binary	
- Frame sequence:	1	binary	
normal	1		
remedial	1	binary	
remediai	1	binary	
2. TUTORIAL POINTER TABLE (TPT) :			
- SCR pointer	3	,	
- SRT pointer	3	,	
- SPR pointer	3	,	
- LCR pointer	3)	
- SIB pointer	3)binary	Standard Pointer
- LAR pointer	3	,	format
- GRT pointer	3	,	
on pointer		,	
3. FRAME RECORDS TABLE (FRT) :			
- question number	1	binary	
- PQR pointer	3) binary	1
- PAR pointer	3) (standard)repeated 40
- HIR pointer	3) pointer) times
- CIR pointer	3) format)) cimes
CIN POINCE		, Tornide,	,
4. FRAME ANALYSIS TABLE (FAT) :			
- question number	1	binary)
- no. times used	3))
- no. attempts	3))Repeated 40
- no. times incorrect	3))times, but
- no. times hint requested	3)) only those
- no. times answer requested	3) packed)entries
- total marks awarded:))corresponding
(a) easy mode	4)) to no. frames
(b) hard mode	4))actually used.
5. SYNTAX DEFINITION TABLE (SDT) :			* see Appendix
- space flags	4)	3.1, SIB
- punctuation flag	1)	Entry, for
- leading zeros flag	1) binary	further
- redundant brackets flag	1)	information
- deletion table	16	character	(SDT area may
- conversion indicator	1	character	be blank if
- substitution table :			Syntax Info.
(a) no. entries	1	binary	Record does not
(b) entries	40	character	exist).
- stop word table			
(a) no. entries	1	binary	
(b) entries	150	character	
- keyword tables	80	character	

Field	Size	Format	Comments	
variable word tablesword limitword length table	80 1 12	character binary binary		

N.B.: The Tutorial Status Control Block (TSCB) resides in the TLCS Data Nucleus, TUTDN, and is the major control component of a student session.

APPENDIX 9.2 - TLCS Software Details

MODULE	LANGUAGE	SIZE	CALLS:
TUTOR	Assembler	2810	All other TLCS modules + DFS DIOS EMS KRES
REGISTER	Assembler	1171	DFS DIOS KRES
LOOKUP	Assembler	1122	DIOS
BLAKBORD	Assembler	1142	DFS
CHECKER	Assembler	3313	DFS DIOS KRES
PLEASIR	Assembler	2148	DFS DIOS KRES
MARKER	COBOL	2302	DFS DIOS KRES
TOT	AL SIZE	14008	

N.B. Most student session data is held in the TLCS Data Nucleus, TUTDN (Size: 3376 bytes). All of the above modules use this area during their processing.

Total TLCS size therefore:

14008 + 3376 = 17384 bytes

(a) General details

Language	ASSEMBLER				
Program size	5044 bytes				
Carl marking	(In addition to this several areas of the control				
	data nucleus CYBDN are used for processing)				
Subordinate modules	None with KRES itself, although calls to the				
	Display Format Subsystem (DFS) and Immediate				
	Command Execution Subsystem (ICES) are used.				
I/O macros used	RDTERM } VM/CMS macros				

(b) Specific lexical analysis techniques

- (i) Conversion to upper case:
 - effected by logical OR of each character with X'40'. For example:
 - 'b' EBCDIC code X'82', binary equivalent

1000 0010

'B' - EBCDIC code X'C2', binary equivalent

1100 0010

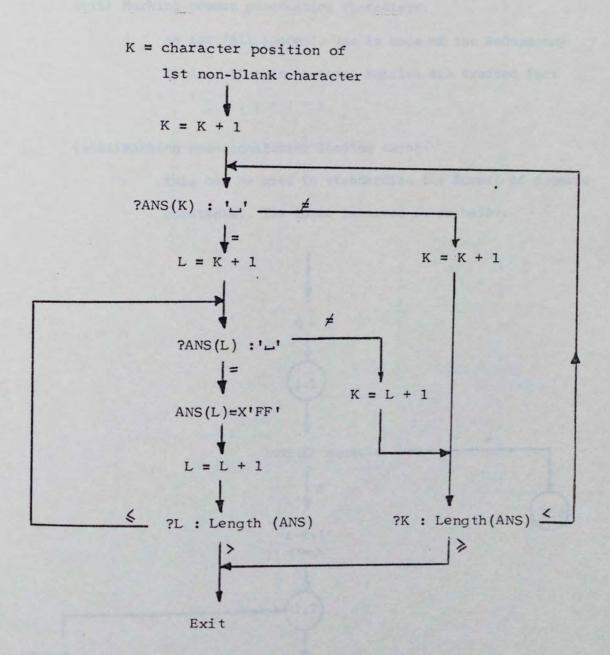
i.e.		1000	0010	(X'82')
	OR	0100	0000	(X'40')
	gives	1100	0010	(X'C2')

(ii) Conversion to lower case:-

- effected by logical AND of each character with an EBCDIC code of < X'FO' with X'BF' For example:</p>

	1100	0010	(X'C2')
AND	1011	1111	(X'BF')
gives	1000	0010	(X'82')

- (iii) Marking leading spaces:
 - input string is scanned from left for non-blank characters. Any blanks encountered are replaced with X'FF'. The operation terminates at the first non-blank.
- (iv) Marking non-delimiting spaces:
 - i.e. extra spaces in between words. This can be used to ensure that all data items in the string are separated by a single blank. The logic involved is as follows:



- (v) Marking all spaces:
 - the space character (X'40') is placed in the Redundancy Table, which is then used as outlined later.
- (vi) Marking trailing spaces:
 - examination begins at the righthand end of the input string (length identified by RDTERM macros and deposited in Register 0). The string is then scanned leftwards until a non-blank is encountered, reducing the defined string length by 1 each time.

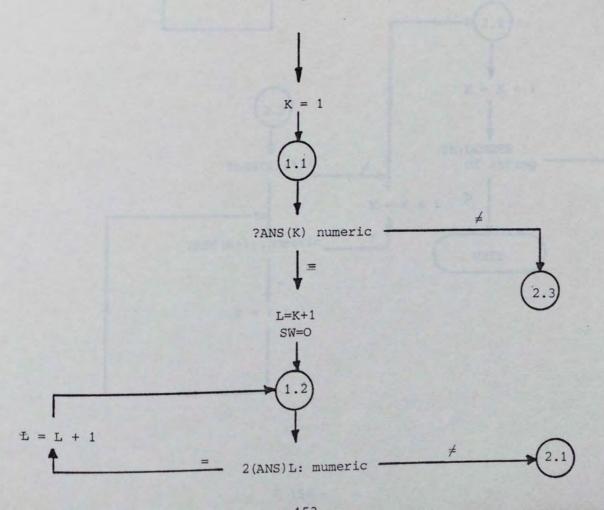
(vii) Marking common punctuation characters:

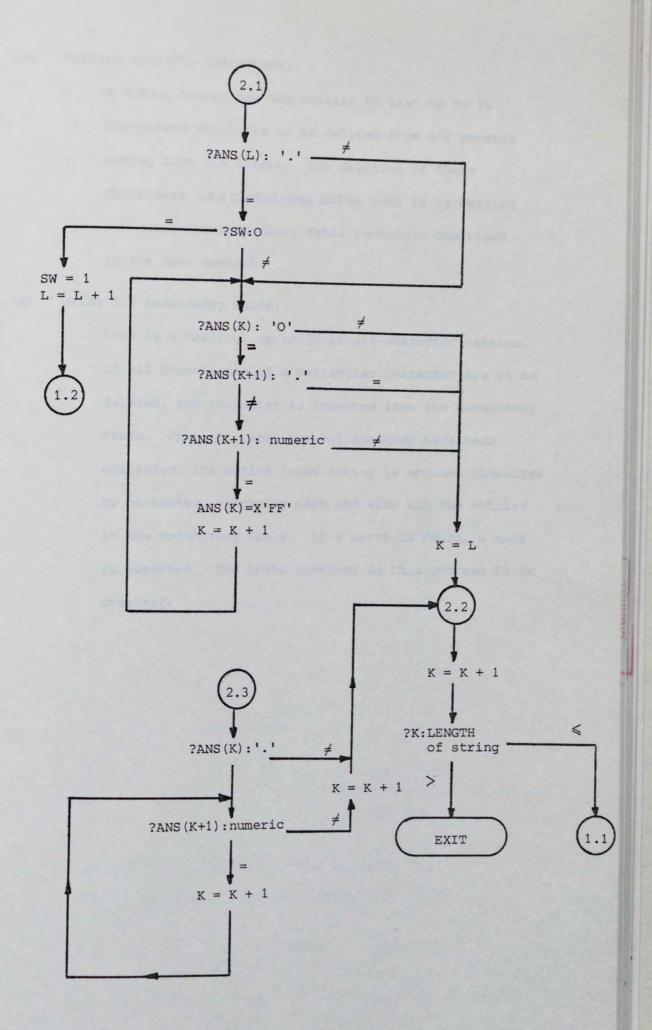
- as for 'All spaces', use is made of the Redundancy
Table. In this instance entries are created for:

, . : ; " ! ! ?

(viii) Marking non-significant leading zeros:

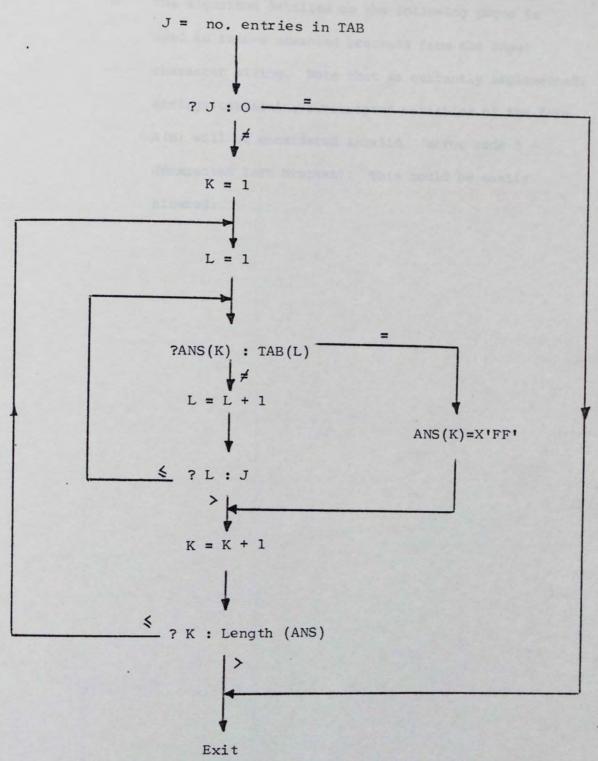
- this can be used to standardise the format of numeric constants. The logic involved is as below:





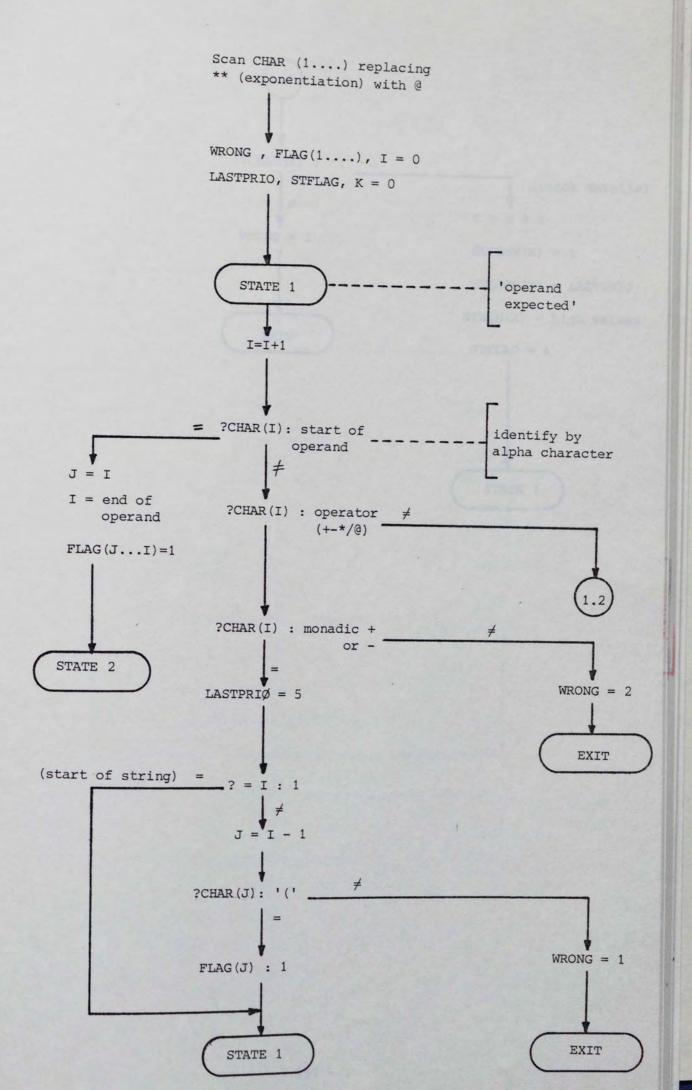
- ix) Marking specific characters:
 - a SCHOOL Author has the ability to list up to 16 characters which are to be deleted from any message coming into his lesson. The deletion of these characters is a global one, and as such it is carried out using the Redundancy Table technique described in the next section.
- (x) Using the Redundancy Table:
 - this is a table of up to 30 single-character entries.

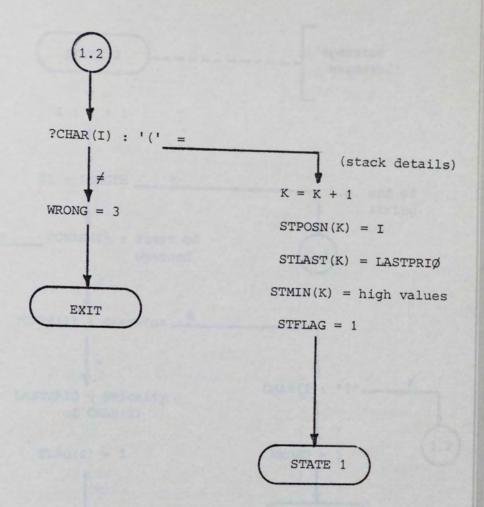
 If all occurrences of a particular character are to be deleted, the character is inserted into the Redundancy Table. When all Local removal searches have been completed, the entire input string is scanned character by character, comparing each one with all the entries in the Redundancy Table. If a match is found, a mark is inserted. The logic involved in this process is as overleaf:

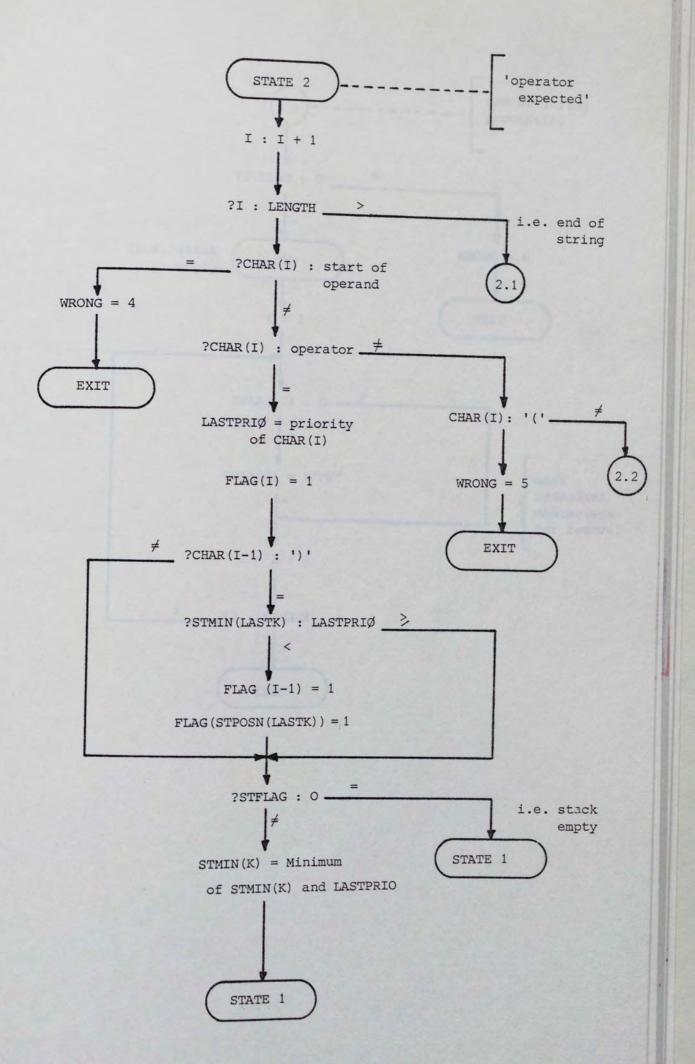


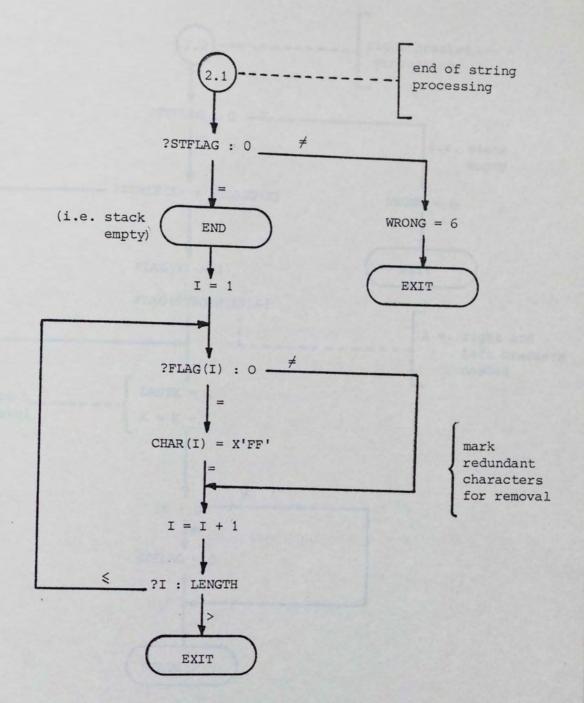
Where ANS(i) is character i of the input string
TAB(i) is entry i of the Redundancy Table

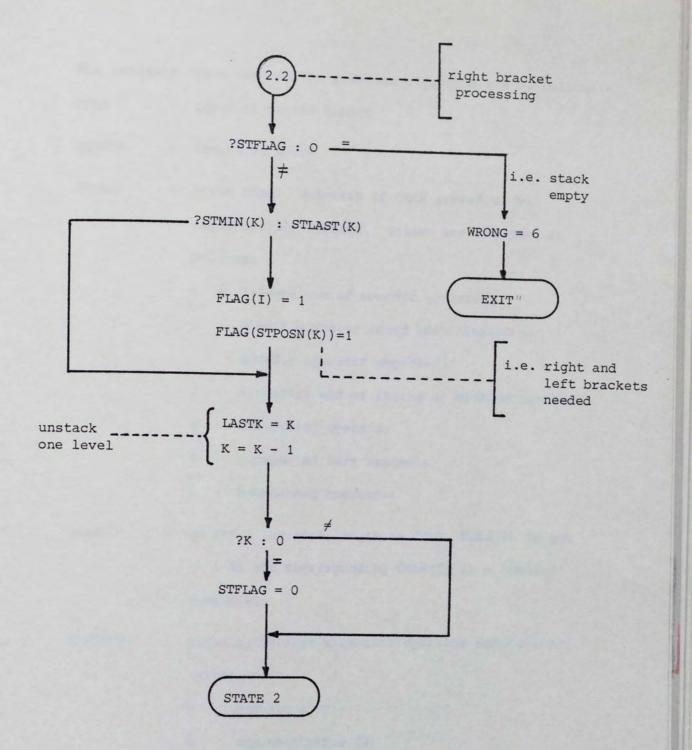
- (xi) Marking redundant parentheses:
 - the algorithm detailed on the following pages is used to remove unwanted brackets from the input character string. Note that as currently implemented, strings containing subscripted variables of the form A(B) will be considered invalid (error code 5 Unexpected left bracket). This could be easily altered.











The variable names used in the previous algorithm are as follows:-- input character length CHAR LENGTH - length of above - error flag. Non-zero if CHAR proved to be WRONG algebraically invalid. Values are assigned as follows: 1 - Illegal use of monadic operator; 2 - Diadic operator found when operand or monadic operator expected; 3 - Premature end of string or missing operand; 4 - Unexpected operand; 5 - Unexpected left bracket; 6 - Unbalanced brackets; - an array the same length as CHAR, FLAG(I) is set FLAG to 1 if the corresponding CHAR(I) is a 'needed' character. - priority of last algebraic operator encountered. LASTPRIO Values are: 5 monadic + or -4 exponentiation (@) 3 2 1 I) - indices to CHAR and FLAG J - index to stack entries K

LASTK - value of K at last unstack operation

STFLAG - stack empty flag (0 if empty, 1 if not)

The following three fields represent related stack entries (as indexed by K):

STPØSN - position in CHAR of located left bracket

STLAST - priority of last operator encountered before this left bracket

STMIN - minimum operator priority encountered within brackets so far.

These stack entries are operated in a 'Last in First Out' (LIFO) mode.

APPENDIX 11.1 - ICES Software protocols.

The purpose of this Appendix is to clarify source of the more important software techniques used in building the Immediate Command Execution Subsystem, ICES.

The techniques covered are as follows:

(a) Function Command Codes

- each Immediate command has associated with it a 1-byte binary command code, which is used internally to control various aspects of processing. Allocations are as follows:-

Hexadecimal value(s)	Significance
00	Normal input (not Immediate command)
01 - OF	Not allocated
10 - 3F	Immediate command:
190025	- student level
	- transient effect
40 - 6F	Immediate command:
10000	- student level
	- permanent effect
70 - 7F	Not allocated
80 - FF	Immediate command:
version in	- author and supervisor levels
270170	

N.B. Refer to module MONITOR coding, table CCT for actual allocated values.

(b) Internal/External coding

- some ICES functions are processed internally within module MONITOR, whereas others are supported by standalone program modules. The following table defines this organisation:

Command	Internal	External
*ABABDON		х
*ANSWER	Man and the	x
*AUTHOR	x	
*CØMMENT		х
*CURRENT	x	
*DETAILS	Side that	х
*FINISH	X	THE RESERVE AND ADDRESS.
*GLØSSARY		Х
*HINT		х
*LIST	X	At all the styles
*MESSAGES	A STATE OF THE PARTY OF	X
*REPEAT		х
*RESCREEN	х	
*RESUME		х
*SCØRE	х	
*SUSPEND		x
*ANALYSIS		X
*CØPYØN	х	
*CØPYØFF	х	
*HISTØRY		x
*PRØCEED	X	

(Internally-supported commands tend to be those which are processed most easily).

(c) Register conventions

- (i) Externally-supported commands:-
 - normal conventions apply; no extra restrictions;
- (ii) Internally-supported commands:-
 - only registers R2 to R8 are available for processing, and register R14 is used for subroutine linkage. The above convention <u>must</u> be adhered to otherwise SCHOOL session

processing may become unpredictable. Furthermore if the internal ICES subroutine calls any other module, the contents of R14 <u>must</u> be preserved using the temporary save area LINK within module MONITOR.

(d) Data and System Progress Integrity

- when the flow of a SCHOOL session is interrupted by an

 Immediate command, it is important to preserve system status

 while the command is processed. Once complete, normal

 execution may then resume satisfactorily. Several techniques

 are employed to achieve this:
 - (i) Function Authorisation (FALEVEL) and System Progress (SPLEVEL) parameters:
 - ensure that only authorised operations may take
 place at various stages of system execution;

(ii) Special address blocks:

held in the central data nucleus CYBDN, these
 preserve all relevant system status addresses,
 e.g. base register values, data nucleus addresses,
 system termination routine addresses etc.
 (see CYBDN for full details).

(iii) Screen contents buffer:

- if relevant, the output from an Immediate command is displayed alongside the normal session dialogue. This tends to be the exception rather than the rule, and usually ICES output is displayed on a new screen. To facilitate this, existing screen contents are put in a temporary buffer and redisplayed once ICES processing is complete (at the user's instigation).

APPENDIX 12.1 - Extracts from SCHOOL Supervisor Guide

This Appendix contains 3 extracts from the SCHOOL Supervisor Guide:

- i) use of the DBPRINT command and sample output;
- ii) use of the TIMESET command;
- iii) details of SCHOOL System Utility program SCHUTL.

Command: DBPRINT

Function: To produce a formatted print of SCHOOL Database contents.

Notes:

i) Each DBTU is printed as a separate record (current length 200 bytes);

- ii) Record contents are printed in two parts:
 - hexadecimal presentation of contents;
 - character equivalent (if any byte is not capable of being displayed, its contents are shown as a fullstop).

Options: i) Number of DBTU's to displayed:

n - will print first n DBTU's;

ALL - will print entire database or first 32000 DBTU's, whichever is smaller.

ii) Output device:

TERMINAL - output will appear at terminal;

PRINTER - output will be printed on the mainframe printer.

Example: Sample output from the DBPRINT command may be found overleaf.

N.B: Only 104 records are shown.

Also for clarity text has not been compressed.

PARM FIELD -RECORDS=32000 DSNAME=SCHOOL DATABASEA1

VOLUME=

DISPL. DESCRIPTION DESCR	0 *.1.02M28948ELANS3* 0 *SYSTEM CHECKOUTCMS EDITINGF* 2 *UNDAMENTALSMVS OPERATINGLOTUS* 3 *	** COMPONER DUMMY RUN GMB* ** FURTHER RUN MIKES GMB* ** FDRTHER RUN KINETICS TESTRUN* ** TOPESBO SAMPLE RUN	* SAMPLE 82 *MS EDITOR *DS	жж	***		***	**	**
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SIMPLE COMMANDS USED TO ALTER THE CONTEN ** *********************************	*G LINESDELETE . REMOVING *	***	1940 *EDIT AND INPUT MODES ** FFF *MIKE LITTLE ** FFF **	***	***	** COVERS THE MODES THAT ARE AVAILABLE ** THE USER DURING EDIT SESSIONS. AND ** THE USER DURING EDIT SESSIONS.	* * * * * * * * * * * * * * * * * * *	* TLE TRAINING SCHOOL COMPOWER	NTRODUCTION TO THE MYSIERIES OF THE UTER HOPEFULLY YOU WON.T FIND IT	*EXTENT INTERESTING*
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0000	0000 0000 0000 0000 0012 0016	DISP 0000 0000 0000	00000	0000	0000		0000	200000	

	***		****		**************************************			TLE COMPOWER 250980MIKE LIT	:::
00 05000000FFFFFFFFD4010492D01D4C9D2C540D3C9E3E3D3C540404040404404040404040404040404040404	11. RECORD NO. 76 LENGTH 200 SOOODOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO	11. SAME AS ABOVE	11. 05FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF	L. 0. 06 FFFFFFFFFF TO 0. 79 LENGTH 200 0. 06 FFFFFFFF TO 0.000 0.	L. 03000000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFF	L. 35FFFFFF000000A0001FFFF00000FFFFFF00000FFFFF000000FFFFF0000	L. 06 FFFFFFFFFFFF T CORD NO. 82 LENGTH 200 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	L. 03000000FFFFFFA00001C348C248E348404040404040404017F2F5F0F9F8F0D4C9D2C540D3C9E3	1. SEFERE 000000 NO. 84 LENGTH 200 FFFFF 000000 FFFFF 00000 FFFFFF
00000 00040 00080 00120 00160	DISPL 00000 00060 00060	DISPL 00000 00040 00040	DISPL 00000 000040 00080 00120	DISPL 00000 00040 00080	DISPL 00000 00040 000120 00120	DISPL 00000 00004 00008 00120 00160	DISPL 00000 000040 000080	DISPL 00000 00040 00080 00120 00160	100000 1000000 10000000000000000000000

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***	***	F *THIS. THE FIRST IN THE * 0 * SEQUENCE OF SIX LESSONS. DISCUSSES THE * 9 *GROW. OF COMPOMER FROM NCB COMPUTER SER* 0 *VICES AS COMPUTER UTILISATION WIT	**************************************	**************************************	**	** ** ** ** ** ** ** ** ** ** ** ** **	* ARE WITHIN THE CATEGORY OF GENERAL KNOWN **LEDGE*	ж жж	E3 *FURTHER RUN .280978MIKE LIT* 60 *TLE TRAINING SCHOOL COMPOWER* FF ** FF ** FF **
SPL. 000 0500000000000020005BFFFFFFFFFFFFFFFFFFFF	SPL. 000 05000000000000200058FFFFFFFFFFFFFFFFFFFF	SPL. 100 0500000000000020005BFFFFFFFFFFFFFFFFFFFF	SPL. 000 05FFFFF0000020005BC9D5C4E4E2E3D9E840C8C1E240C3C8C1D5C7C5C44B0000000000000000000000000000000000	SPL. 00 06 FFFFFFFFFFFFFFFFF 000640000000000	SPL. 000 03000000FFFFFFFFFFFFFFFFFFFFFFFFFFF	PL. 0300000000000000000000000000000000000	PL. 100 03FFFFFF000000A0001C9C1D340C5E7C5C3E4E3C9D6D54B03063BC1D3D340D8E4C5E2E3C9D6D5E 40 405C4C7C54B000000000000000000000000000000000000		PL. 03000000FFFFFA00001C6E4D9E3C8C5D940D9E4D540404040002F2F8F0F9F7F8D4C9D2C540D3C9E3 40 E3D3C540404040402D02C540D3C9E3 40 E3D3C540404040402D02C540D3C9E3 40 E3D3C5404040404040E3D9C1C9D5C9D5C740E2C3C8D6D6D5A0C3D6D4D7D6E6C5D9400380006C80007260 30 0078FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
10000	10000	100000	1000	0000	100000	0000 0000 0000 0001	00000	0000	0000 0000 0001

Command:

TIMESET

Function:

To suspend SCHOOL system operations at various

levels of user until a defined date and time.

Notes:

TIMESET should be used to suspend access to SCHOOL

during execution of the following Supervisor commands:

BACKUP

DBPRINT

DBTUMAP

REORG

RESTORE

Options: i) TIMESET operation:

ON - suspends SCHOOL

ØFF - restarts SCHOOL, and

resets any previous

active suspension.

ii) User level:

STUDENT)

) indicates users to

AUTHOR)

ALL

) be denied access.

iii) Date:

DDMMYY - date of resumption

of operations

iv) Time:

HHMMSS - time of resumption

of operations (24

hour clock)

Example: A sample TIMESET dialogue follows:

SCHOOL System Utility Program: SCHUTL

Three significant maintenance functions have not been included within SCS Command repertoire. This has been done for security reasons and a separate utility program SCHUTL has been created to satisfy these requirements, which are:

- i) delete the entire SCHOOL database;
- ii) reset the SCHOOL database (no subjects, no lessons, only
 MCR and BMT in existence);
- iii) direct physical DBTU access, alteration and deletion.

 WARNING: Great care must be taken when using SCHUTL ensure that all user access has been terminated prior to using this facility.

Executing SCHUTL:

- i) Logon to CMS account TS020
 - the current password will need to be supplied.
- ii) Specify Type-of-work code 9 for Project Control.
- iii) Enter:

SCHUTL function password

- when 'function' and 'password' are selected as below:

function	password	comments
DBD	FDV640V	Deletes complete
		existing SCHOOL
		database
MCR	PHD947	Resets database to
		'MCR/BMT-only' status
DBTU	714ABL	Direct DBTU access
		sequence

N.B: In all of the above sequences, checkpoint prompts of the form:

WARNING: MESSAGE

..... DO YOU WISH TO PROCEED?

are incorporated. Please ensure that
the message is checked and understood
before answering.

SCHOOL Supervisor Guide

SCS Module	Supported Command
SCSACTIV	ACTIVE
SCSAUTH	AUTHØRS
SCSBACK	BACKUP
SCSDBPR	DBPRINT
SCSDBTU	DBTUMAP
SCSGMRD	GMRDEL
SCSGMRE	GMREDIT
SCSGMRG	GMRGEN
SCSGMRL	GMRLIST -
SCSMANGR	MANAGERS
SCSPASS	PASSWØRD
SCSREØRG	REØRG
SCSREST	RESTØRE
SCSSCRD	SCRDEL
SCSSTUD	STUDENTS
SCSSUBJ	SUBJECTS
SCSSUBRF	SUBREFNØ
SCSSYSBS	SYSBØSS
SCSTIME	TIMESET
SCSVERSN	VERSION
	(END+ERRORS;
SUPERVYS	(also control
	(module.
	(module.