B5700 JOB MANAGEMENT WORKING SET

(AUTOMATIC JOB SUSPENSION)

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INTRODUCTION

ONE ADVANTAGE OF A MULTIPROCESSING ENVIRONMENT IS THAT IT PERMITS SEVERAL JOBS TO BE RUN SIMULTANEOUSLY IN A PERIOD OF TIME WHICH IS LESS THAN THE TOTAL TIME REQUIRED TO RUN THE JOBS SERIALLY (ONE JOB AT A TIME, IN SEQUENCE). HOWEVER, IF A NUMBER OF JOBS ARE RUNNING SIMULTANEOUSLY, THERE IS A GOOD CHANCE THAT THE TOTAL SYSTEM PERFORMANCE HAS BEEN GREATLY DEGRADED. THIS IS BECAUSE THE OPERATING SYSTEM IS SPENDING SO MUCH TIME MANAGING MEMORY (I.E., CONTINUOUSLY OVERLAYING CODE AND DATA SEGMENTS TO OBTAIN SUFFICIENT CORE MEMORY FOR EACH JOB). THE JOB MANAGEMENT WORKING SET (AUTOMATIC JOB SUSPENSION) HAS BEEN IMPLEMENTED TO ELIMINATE THE DEGRADATION OF SYSTEM PERFORMANCE AND TO ASSURE THAT THE AMOUNT OF TIME REQUIRED TO RUN THE JOBS SIMULTANEOUSLY IS NOT LONGER THAN THE TIME REQUIRED TO RUN THEM SERIALLY.

WHEN THE OPERATING SYSTEM IS SPENDING SO MUCH TIME TRYING TO MANAGE MEMORY DEMANDS THAT THE TOTAL SYSTEM PERFORMANCE IS DEGRADED, THE SYSTEM IS SAID TO BE "THRASHING". THE B5700 WORKING SET IS DESIGNED TO DETECT "THRASHING" AND TO TEMPORARILY SUSPEND ONE OR MORE OF THE JOBS IN THE MIX WHEN IT OCCURS. THIS PERMITS THE REMAINING JOBS TO BE RUN TO COMPLETION IN A NON-THRASHING ENVIRONMENT, GREATLY REDUCING THE TOTAL TIME REQUIRED TO RUN ALL OF THE JOBS, INCLUDING THOSE WHICH ARE TEMPORARILY SUSPENDED.

THE PRIMARY CAUSE OF THRASHING IS INSUFFICIENT CORE MEMORY FOR THE JOBS IN THE MIX. THIS HAPPENS BECAUSE OF 1) POOR CORE ESTIMATES FOR A GIVEN JOB; 2) INAPPROPRIATE USE OF THE "XS" KEYIN; OR 3) SETTING THE CORE FACTOR TOO HIGH.

THE WORKSET ROUTINE IS PRIMARILY BASED ON THE DETECTION OF THRASHING BY A COMPARISON OF THE OVERLAY OVERHEAD TIME AND THE ACTUAL PROCESSOR TIME. THEREFORE, WHEN "WORKSET" IS COMPILED INTO THE MCP, THE OPTION "NEWLOGGING" SHOULD ALSO BE COMPILED IN. IF THE NEWLOGGING OPTION IS NOT COMPILED IN, ERRATIC RESULTS MAY OCCUR.

TWO NEW PROCEDURES, PROCEDURE WORKSET AND PROCEDURE WORKSETREQUESTS, HAVE BEEN INCORPORATED IN ORDER TO IMPLEMENT THE B5700 MANAGEMENT WORKING SET. ALSO, A NEW MCP OPTION, WORKSETMONITOR HAS BEEN ADDED. PROCEDURE WORKSET IS RESPONSIBLE FOR DETERMINING 1) WHEN A JOB SHOULD BE SUSPENDED, AND 2) WHICH JOB SHOULD BE SUSPENDED. PROCEDURE WORKSETREQUESTS IS CALLED TO HANDLE ALL KEYBOARD INPUT REQUESTS PERTAINING TO THE MANAGEMENT WORKING SET. THE WORKSETMONITOR COMPILE-TIME OPTION MONITORS THE WORKSET PARAMETER VALUES (DISCUSSED LATER).

PROCEDURE WORKSET

WHEN A DATA OR CODE SEGMENT IS OVERLAYED, A SMALL AMOUNT OF OVERHEAD IS INCURRED BY THE JOB. THIS OVERHEAD IS PERIODICALLY COMPARED, BY PROCEDURE WORKSET, TO THE ACTUAL AMOUNT OF PROCESSING TIME FOR ALL JOBS IN THE MIX. WHEN THE AMOUNT OF OVERHEAD EXCEEDS "OLAYMAX" (DISCUSSED LATER) ONE OR MORE OF THE JOBS IN THE MIX WILL BE SUSPENDED TO REDUCE THE OVERHEAD FOR THE REMAINING JOBS. A JOB WILL NOT BE SUSPENDED WITHIN 15 SECONDS AFTER AN EOJ, BOJ, OR RE-START. ALSO, "LDCNTRL/DISK", "LIBMAIN/DISK", AND "PRNPBT/DISK" ARE NEVER SUSPENDED BY PROCEDURE WORKSET. NEITHER ARE THEY COUNTED INTO THE NUMBER OF JOBS IN THE MIX. IF ONLY ONE JOB IS RUNNING WHEN THE THRASHING POINT IS REACHED, IT WILL NOT BE SUSPENDED (NOTE: REMEMBER THAT THE SYSTEM JOBS, "LIBMAIN" ETC., WILL NOT BE COUNTED AS JOBS).

WHEN PROCEDURE WORKSET SUSPENDS A JOB, OR WHEN THE OVERLAY OVERHEAD TIME IS 85% OF OLAYMAX, PROCEDURE SELECTRUN WILL NOT ALLOW ANY ADDITIONAL JOBS TO ENTER THE MIX EXCEPT SYSTEM JOBS (E.G., LIBMAIN). THE "XS" KEYIN MAY BE USED TO FORCE A JOB INTO THE MIX.

WHEN PROCEDURE WORKSET SUSPENDS A JOB, THE MESSAGE:

#AUTO-STOP <MFID>/<FID> = <MIX INDEX>

IS DISPLAYED AT THE SPO. AN INDEX TO THE JOB IS PLACED IN A QUEUE FOR SUSPENDED JOBS. WHEN ANOTHER JOB GOES TO EOJ, THE FIRST JOB SUSPENDED IS RE-ENTERED INTO THE MIX AND THE MESSAGE:

#AUTO-OK <MFID>/<FID> = <MIX INDEX>

IS DISPLAYED. A JOB MAY BE FORCED FROM THE QUEUE BY AN "OK" KEYIN. WHEN THIS OCCURS, THE AMOUNT OF OVERLAY OVERHEAD FOR THE JOB IS SET BACK TO 80% OF ITS FORMER VALUE SO THAT THE JOB WILL NOT BE IMMEDIATELY RESUSPENDED.

PROCEDURE WORKSETREQUESTS

PROCEDURE WORKSETREQUESTS HANDLES ALL KEYBOARD INPUT REQUESTS PERTAINING TO THE MANAGEMENT WORKING SET. THE BASIC FORM OF THE WORKSET KEYIN IS "WK". WHEN "WK" IS KEYED-IN, THE VALUE ASSOCIATED WITH THE WORKSET PARAMETERS ARE PRINTED AS WELL AS ALL OF THE WORKSET OPTIONS WHICH ARE SET. THE RESPONSE TO THE "WK" KEYIN IS IN THE FOLLOWING FORMAT:

WKSET CYCLE=<N>, DLAY=<N>, TOL=<N>, OPTIONS: <O>, <O>,...<O>

WHEN AN INCORRECT "WK" KEYIN IS ENTERED, AN ERROR MESSAGE WILL BE PRINTED AT THE SPO, AS FOR ALL INCORRECT KEYIN REQUESTS. HOWEVER, IN THE CASE OF THE "WK" KEYIN, A PORTION OF THE REQUEST MAY BE EXECUTED PRIOR TO FINDING THE ERROR. FOR EXAMPLE:

WK CYCLE=25, DLAY=15, TIL=18
("TIL" SHOULD BE "TOL")

WOULD BE RECOGNIZED AS A VALID REQUEST EXCEPT FOR THE "TIL". THE SYSTEM WILL RESPOND:

WK: ERROR:TIL=18 CYCLE=25,DLAY=25

WHICH INDICATES THAT THE REQUEST WAS ABORTED WHEN "TIL" WAS ENCOUNTERED AND ALL PORTIONS PRECEDING THE "TIL" WERE ACCEPTED.

WORKSETMONITOR

THE WORKSETMONITOR MONITORS THE WORKSET PARAMETER VALUES. THE MONITOR MAY BE SET OR RESET BY THE FOLLOWING (WHEN WORKSETMONITOR IS COMPILED INTO THE MCP):

WK MONITOR = 1

OR

WK MONITOR = 0

A VALUE OF 1 SETS THE MONITOR AND A VALUE OF 0 RESETS IT. WHEN THE MONITOR IS SET, EACH TIME PROCEDURE WORKSET SUSPENDS A JOB, THE VALUES FOR THE WORKSET OPTIONS ARE PRINTED AT THE SPO FOR EACH JOB IN THE MIX. ALSO, EACH TIME A JOB GOES TO EOJ, THE AMOUNT OF PROCESSOR, I/O, AND ELAPSED TIME IS PRINTED AT THE SPO. THIS INFORMATION IS HELPFUL WHEN CHOOSING PARAMETERS.

SUSPENSION OF ONE OR MORE OF THE JOBS IN THE MIX IS A RELATIVELY STRAIGHT FORWARD REMEDY FOR THRASHING. HOWEVER, THE FACTORS REGARDING WHEN TO SUSPEND A JOB, AND WHICH JOB TO SUSPEND, CAN BE COMPLEX AND MAY CHANGE DRASTICALLY DEPENDING ON THE NATURE OF THE JOBS IN THE MIX. THEREFORE, WORKING SET HAS BEEN MADE AS FLEXIBLE AS POSSIBLE, SO THAT IT MAY BE TUNED TO THE NEEDS OF THE SYSTEM UTILIZING IT. THIS FLEXIBILITY IS PROVIDED BY SPECIAL WORKSET OPTIONS AND WORKSET PARAMETERS.

WORKSET OPTIONS

PROCEDURE WORKSET USES 5 OPTIONS TO DECIDE WHICH JOB SHOULD BE SUSPENDED. THESE OPTIONS ARE:

1) OLAY RATE (THE OVERLAY OVERHEAD TIME EXPRESSED AS A PERCENTAGE OF THE PROCESS TIME), DEFINED AS

$$\frac{\text{<AMOUNT OF OVERHEAD TIME FOR OVERLAY>}}{\text{<AMOUNT OF ACTUAL PROCESSOR TIME>}} \times 100$$

2) PRIORITY (THE SYSTEM PRIORITY ASSOCIATED WITH THE JOB)

3) TIME (THE ELAPSED TIME FOR THE JOB)

4) CORE (THE AMOUNT OF OVERLAYABLE CORE USED BY THE JOB)

5) SAVECORE (THE AMOUNT OF NON-OVERLAYABLE CORE FOR THE JOB.

THE WORKSET OPTIONS MAY BE SET FROM THE SPO BY USE OF THE "WK" KEYIN. THE FORMAT IS:

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WK USE <O>,<O>,...<O>
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FOR EXAMPLE:

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WK USE OLAY,TIME,CORE
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THE EXAMPLE WILL SET THE WORKSET OPTIONS TO OVERLAY OVERHEAD TIME, ELAPSED TIME, AND OVERLAYABLE CORE, IN THAT ORDER; AND, THE SYSTEM WILL RESPOND WITH:

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WKSET OPTIONS: OLAY,TIME,CORE
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PROCEDURE WORKSETREQUESTS LOOKS ONLY AT THE FIRST 3 LETTERS OF THE OPTION NAME. THEREFORE, EACH OPTION MAY BE ABBREVIATED TO 3 LETTERS.

TO INQUIRE AS TO WHICH OPTIONS ARE SET, THE INPUT:

WK OPTIONS

MAY BE ENTERED. THE SYSTEM WILL RESPOND WITH:

WKSET OPTIONS: <0>,<0>,...<0>

EXAMPLE

WK USE OLAY,TIME,CORE

WHEN THE ABOVE KEYIN HAS BEEN ENTERED AND THE SYSTEM IS THRASHING, PROCEDURE WORKSET WILL SELECT A CANDIDATE FOR SUSPENSION BASED ON THE OVERLAY OVERHEAD TIME, THE ELAPSED TIME, AND THE AMOUNT OF OVERLAYABLE CORE, IN THAT ORDER.

PROCEDURE WORKSET WILL EXAMINE ALL JOBS IN THE MIX TO DETERMINE WHICH JOB HAS THE MAXIMUM OVERLAY TIME. THEN, ALL JOBS WHICH HAVE AN OVERLAY TIME WHICH IS WITHIN A FIXED PERCENTAGE OF THE MAXIMUM OVERLAY TIME, ARE RETAINED FOR FURTHER EXAMINATION. (THE PERCENTAGE IS SPECIFIED BY "TOLERANCE" WHICH IS DISCUSSED WITH THE PARAMETERS.) THE REMAINING JOBS IN THE MIX ARE ELIMINATED FROM FURTHER CONSIDERATION.

NEXT, PROCEDURE WORKSET EXAMINES THE RETAINED JOBS TO DETERMINE WHICH JOB HAS BEEN RUNNING FOR THE SHORTEST PERIOD OF TIME. THEN, ALL JOBS WHICH HAVE AN ELAPSED TIME WHICH IS WITHIN A FIXED PERCENTAGE OF THE MINIMUM ELAPSED TIME, ARE RETAINED FOR FURTHER EXAMINATION. (THE PERCENTAGE IS SPECIFIED BY "TOLERANCE" WHICH IS DISCUSSED WITH THE PARAMETERS.) THE REMAINING JOBS IN THE MIX ARE ELIMINATED FROM FURTHER CONSIDERATION.

FINALLY, PROCEDURE WORKSET EXAMINES THE RETAINED JOBS TO DETERMINE WHICH JOB IS USING THE MOST OVERLAYABLE CORE. THE JOB USING THE MOST CORE (SINCE THIS IS THE LAST OPTION) IS SELECTED FOR SUSPENSION.

WORKSET PARAMETERS

PROCEDURE WORKSET HAS THREE PARAMETERS WHICH IT USES FOR EVALUATING THE OPTIONS. THESE PARAMETERS ARE:

1) CYCLE (INTERVAL IN SECONDS AT WHICH WORKSET SHOULD RUN)

2) OLAYMAX (TOTAL OVERLAY OVERHEAD PERMITTED, EXPRESSED AS A PERCENT)

$$\frac{\text{<TOTAL AMOUNT OF OVERHEAD TIME FOR OVERLAY>}}{\text{<TOTAL AMOUNT OF ACTUAL PROCESSOR TIME USED>}} \times 100$$

3) TOLERANCE (VARIANCE PERMITTED FROM MAXIMUM OR MINIMUM VALUE, EXPRESSED AS A PERCENT)

VALUES MAY BE ASSIGNED TO THESE PARAMETERS BY A "WK" KEYIN FROM THE SPO. THE FORMAT OF THE MESSAGE IS:

WK <PARAMETER> = <NN>

PROCEDURE WORKSET LOOKS AT ONLY THE FIRST THREE LETTERS OF THE PARAMETER NAME. THEREFORE, EACH PARAMETER MAY BE ABBREVIATED TO THREE LETTERS.

THE VALUES CURRENTLY ASSIGNED TO THE PARAMETERS MAY BE INTERROGATED BY A:

WK <PARAMETER>

MESSAGE. THE SYSTEM WILL RESPOND WITH:

WKSET <PARAMETER>=<NN>,<PARAMETER>=<NN>,...<PARAMETER>=<NN>

ASSIGNMENT AND INQUIRY REQUESTS MAY BE INTERMIXED IN THE SAME "WK" KEYIN. FOR EXAMPLE:

WK CYCLE=30,OLAYMAX,TOLERANCE=15

WOULD BE INTERPRETED AS: 1) SET CYCLE TO 30 SECONDS; 2) PRINT OUT THE CURRENT VALUE OF OLAYMAX; AND 3) SET TOLERANCE TO 15 PERCENT. THE SYSTEM WILL RESPOND WITH:

WKSET CYCLE=30,OLAYMAX=<NN>,TOLERANCE=15

WORKSET OPTIONS AND WORKSET PARAMETERS MAY BE INTERMIXED IN THE SAME "WK" KEYIN. FOR EXAMPLE:

WK CYCLE=15,OLAY=50,USE PRIOR,OLAY,COR,TOL=20

WOULD BE INTERPRETED AS: 1) SET CYCLE TO 15 SECONDS; 2) SET OLAYMAX TO 50%; 3) SET WORKSET OPTIONS: PRIORITY, OLAY, AND CORE, IN THAT ORDER; AND 4) SET TOLERANCE TO 20%. THE SYSTEM WILL RESPOND WITH:

WKSET CYCLE=15,OLAY=50,TOL=20,OPTIONS:PRIORITY,OLAY,CORE

CYCLE PARAMETER

CYCLE IS THE INTERVAL OF TIME, IN SECONDS, AT WHICH PROCEDURE WORKSET SHOULD BE RUN. IF CYCLE = 30, PROCEDURE WORKSET WILL FIRE UP EVERY 30 SECONDS TO CHECK FOR THRASHING. PROCEDURE WORKSET WILL NOT FIRE UP IF CYCLE IS EQUAL TO A NEGATIVE VALUE OR ZERO.

OLAYMAX PARAMETER

OLAYMAX IS USED BY PROCEDURE WORKSET TO DETERMINE WHETHER OR NOT A JOB SHOULD BE SUSPENDED. OLAYMAX IS A PERCENTAGE WHICH IS THE MAXIMUM PERCENTAGE OF OVERLAY TIME PERMITTED.

EACH TIME PROCEDURE WORKSET CYCLES, IT CHECKS THE OLAYMAX PERCENTAGE AGAINST THE TOTAL OVERLAY PERCENTAGE INCURRED BY THE SYSTEM. THE TOTAL OVERLAY PERCENTAGE IS CALCULATED BY DIVIDING THE TOTAL PROCESSOR TIME USED BY THE SYSTEM INTO THE TOTAL OVERLAY OVERHEAD TIME INCURRED BY THE SYSTEM AND MULTIPLYING THE RESULT BY 100. IF THE TOTAL OVERLAY PERCENTAGE IS GREATER THAN OLAYMAX, A JOB WILL BE SUSPENDED BY THE PROCESS OUTLINED WITHIN THE OPTIONS SECTION. ALSO, IF THE OLAY RATE FOR ANY JOB IN THE MIX IS GREATER THAN 4 TIMES THE VALUE OF OLAYMAX, A JOB WILL BE SUSPENDED BY THE PROCESS OUTLINED IN THE OPTIONS SECTION.

TOLERANCE PARAMETER

TOLERANCE IS THE VARIANCE PERMITTED FROM THE MAXIMUM OR MINIMUM VALUE, EXPRESSED AS A PERCENT. IF TOLERANCE = 10, PROCEDURE WORKSET WILL LOOK FOR A CANDIDATE FOR SUSPENSION USING A 10% LEEWAY FROM THE OPTIONS. THIS MEANS, IF THE MAXIMUM OVERLAYABLE CORE (OPTION CORE) IS 12,000, THEN ALL JOBS HAVING AN AMOUNT OF OVERLAYABLE CORE WITHIN 10% OF 12,000 WORDS WILL BE RETAINED AS WELL AS THE ONE HAVING THE 12,000 WORDS. THE TOLERANCE LEVEL APPLIES TO ALL OF THE OPTION. THE FOLLOWING EXAMPLE FURTHER ILLUSTRATES TOLERANCE:

EXAMPLE

TO FURTHER ILLUSTRATE THE USE OF THE TOLERANCE VALUE, ASSUME THAT THERE ARE FOUR JOBS IN THE MIX AND THE WORKSET OPTIONS ARE: OLAY, TIME, AND CORE, IN THAT ORDER.

MIX	OLAY RATE (PERCENT)	ELAPSED TIME (SECONDS)	OVERLAYABLE CORE

1	74	25	14600
2	42	24	8010
3	81	23	11600
4	36	22	6900

PROCEDURE WORKSET WOULD FIRST SELECT <MIX 3> SINCE IT HAS THE HIGHEST OVERLAY TIME (81% OF ITS PROCESS TIME). THEN, ALL JOBS WHICH ARE WITHIN THE TOLERANCE (10%) ARE RETAINED. THE TOLERANCE IS EQUAL TO 81 X 0.10 =8.1%. THEREFORE, <MIX 1> IS RETAINED AND <MIX 2> AND <MIX 4> ARE ELIMINATED.

NEXT, <MIX 1> AND <MIX 3> ARE EXAMINED FOR ELAPSED TIME, AND SINCE THE ELAPSED TIME FOR <MIX 1> IS 25, WHICH IS WITHIN THE TOLERANCE LIMIT FOR THE ELAPSED TIME (23 X 0.1 = 2.3), BOTH JOBS ARE RETAINED FOR FURTHER EXAMINATION.

FINALLY, <MIX 1> AND <MIX 3> ARE EXAMINED TO DETERMINE WHICH JOB IS USING THE MOST OVERLAYABLE CORE. PROCEDURE WORKSET WOULD THEN SELECT <MIX 1> AS THE JOB TO BE SUSPENDED.

THE WORKSET ROUTINE MAY BE INHIBITED BY SETTING CYCLE TO ZERO OR A NEGATIVE VALUE, BUT THIS LOSES THE PREVIOUS VALUE OF CYCLE. THEREFORE, NEW CONSTRUCTS, "WK ON" AND "WK OFF" HAVE BEEN ADDED TO THE WORKSET ROUTINE.

A "WK ON" KEYIN FORCES PROCEDURE WORKSET TO EXAMINE ALL OF THE WORKSET PARAMETERS AND OPTIONS. IF ANY OF THESE DO NOT CONTAIN A VALUE (FROM A PREVIOUS "WK" KEYIN) A DEFAULT VALUE IS ASSIGNED TO IT. THE DEFAULT VALUES ARE:

CYCLE = 20 SECONDS
OLAYMAX = 40 PERCENT
TOLERANCE= 10 PERCENT
OPTIONS = PRIORITY, OLAY, CORE, TIME, SAVECORE

THE SYSTEM WILL RESPOND WITH:

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WKSET CYCLE=20,OLAY=40,TOL=10,OPTIONS:PRIORITY,OLAY,CORE,TIME,SAVECORE
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A "WK OFF" KEYIN CONVERTS THE CYCLE TIME TO A NEGATIVE VALUE, WHICH STOPS WORKSET. ALL OF THE PARAMETER AND OPTION VALUES ARE RETAINED. THE SYSTEM WILL RESPOND WITH:

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WKSET CYCLE=-20,OLAY=40,TOL=10,OPTIONS:PRIORITY,OLAY,CORE,TIME,SAVECORE
```

WHEN THE NEXT "WK ON" IS ENTERED, THE CYCLE TIME WILL BE RECONVERTED TO A POSITIVE VALLE (ITS FORMER VALUE) AND ALL OF THE PARAMETERS AND

OPTIONS WILL RETAIN THEIR FORMER VALUES.

THE "WK ON" AND "WK OFF" KEYINS MAY BE INTERMIXED WITH "WK" ASSIGNMENT AND INQUIRY KEYINS. FOR EXAMPLE:

WK ON OLAY=20

WILL RESTORE ALL PREVIOUS WORKSET PARAMETERS AND OPTIONS TO THEIR PREVIOUS (OR DEFAULT) VALUES EXCEPT FOR CLAYMAX WHICH IS ASSIGNED THE VALUE OF 20.

SUGGESTIONS FOR OPTION SELECTION

THE "PRIORITY" ASSIGNED TO EACH JOB HAS HISTORICALLY BEEN USED TO DETERMINE WHICH JOBS SHOULD BE PLACED IN THE MIX FIRST. FOR SITES WHICH RUN USER JOBS WITH DIFFERENT PRIORITIES, THIS OPTION SHOULD PROBABLY BE THE FIRST ONE USED WHEN SELECTING A CANDIDATE FOR SUSPENSION.

THE REMAINING OPTIONS WILL HAVE TO BE SELECTED EMPIRICALLY BY THE SITE SETTING THEM. JOBS WHICH USE A GREAT DEAL OF NON-OVERLAYABLE CORE SHOULD NOT BE SUSPENDED SINCE THAT CORE WILL BE TIED UP ANYWAY (WHICH IS WHY THE WORKSET ROUTINE LOOKS FOR A MINIMUM VALUE OF NON-OVERLAYABLE CORE DURING ITS SELECTION). THEREFORE, IF THE MIX CONTAINS MANY JOBS WHICH USE A LARGE QUANTITY OF NON-OVERLAYABLE CORE, THE SAVECORE OPTION SHOULD BE PLACED NEAR THE FRONT OF THE WORKSET OPTIONS LIST.

THE OLAY RATE WILL USUALLY BE RELATED TO THE AMOUNT OF OVERLAYABLE CORE USED BY A JOB, BUT NOT NECESSARILY SO. THEREFORE, THESE OPTIONS MAY HAVE TO BE JUGGLED TO FIND THE BEST COMPROMISE.

IT WOULD SEEM TO BE UNFAIR TO PLACE THE ELAPSED TIME AT THE END OF THE WORKSET OPTIONS LIST, SINCE ONE CAN VISUALISE THAT A JOB WHICH HAS BEEN RUNNING FOR A RELATIVELY LONG TIME COULD BE BUMPED OUT BY A JOB WHICH HAS ONLY RECENTLY ENTERED THE MIX. HOWEVER, IT COULD WELL BE THAT THE MOST EFFICIENT WAY TO RUN BOTH JOBS IS TO DO JUST THAT.

SUGGESTIONS FOR PARAMETER SETTINGS

VALUE OF THE TOLERANCE CAN AFFECT THE SELECTION OF A JOB CONSIDERABLY. FOR EXAMPLE, IF ONE WISHES TO USE ALL OF THE WORKSET OPTIONS WITHOUT PLACING VERY MUCH WEIGHT ON ANY SINGLE ONE OF THEM, A RELATIVELY LARGE TOLERANCE VALUE SHOULD BE USED. A 20% TOLERANCE WILL REMOVE THE DISTINCTION BETWEEN A JOB PRIORITY OF 5 AND A JOB PRIORITY OF 4. ON THE OTHER HAND, IF ONE WISHES TO EMPHASIZE THE EFFECT OF ONE PARTICULAR WORKSET OPTION, A VERY SMALL TOLERANCE LEVEL CAN BE USED, OR ONLY ONE WORKSET OPTION SPECIFIED.

THE WORKSET CYCLE TIME SHOULD ALSO BE SET TO A VALUE COMMENSURATE WITH THE TYPE OF JOBS BEING RUN. WHEN A SITE IS RUNNING MANY SMALL JOBS THROUGH THE SYSTEM, A SHORT CYCLE TIME SHOULD BE USED. FOR UNUSUALLY LONG JOBS, THE REVERSE IS TRUE. HOWEVER, THE MINIMUM CYCLE TIME USED SHOULD NOT BE LESS THAN 5 SECONDS TO AVOID SYSTEM INSTABILITY.

THE OLAYMAX VALUE, WHICH IS THE DETECTION POINT FOR THRASHING, WILL ALSO NEED TO BE EMPIRICALLY DETERMINED, SINCE IT DEPENDS UPON THE NATURE OF THE JOBS IN THE MIX. FORTY PERCENT WAS CHOSEN AS THE DEFAULT VALUE. THIS MEANS THAT THE SUM OF THE OVERLAY OVERHEAD TIMES FOR ALL JOBS IN

THE MIX MUST REACH A VALUE WHICH IS GREATER THAN 40 PERCENT OF THE SUM OF THE ACTUAL PROCESSOR TIMES FOR THE MIX. ROUGHLY SPEAKING, THE SYSTEM IS SPENDING 40% OF ITS TIME TRYING TO MANAGE MEMORY.

APPLICATION EXAMPLE

THE FOLLOWING COMPARES THREE JOBS ALL STARTED AT APPROXIMATELY THE SAME TIME. THE ONLY FACTOR WHICH VARIES IS THE OLAYMAX PARAMETER. THE WORKSET PARAMETER SETTINGS WERE: CYCLE = 20 AND TOLERANCE = 10. THE WORKSET OPTION LIST WAS AS FOLLOWS: PRIORITY,OLAY,CORE,TIME,SAVECORE.

THE JOBS IN THE MIX WERE:

MIX=1, AN ESPOL COMPILATION OF A PORTION OF THE MCP
MIX=2, AN ALGOL COMPILATION OF A PORTION OF THE COBOL COMPILER
MIX=3, AN ESPOL COMPILATION OF A PORTION OF THE MCP

THE FOLLOWING PAGES SHOW THE EFFECT OF OLAYMAX, RANGING FROM 20 PERCENT TO 60 PERCENT.

OLAYMAX = 20%

MIX	OLAY RATE	PRIORITY	TIME	CORE	SAVECORE
1	19%	5	30 SEC	6387 WDS	3971 WDS
2	33%	5	29 SEC	5822 WDS	3423 WDS
3	22%	5	28 SEC	2295 WDS	3868 WDS
SYSTEM	25%				

#AUTO-STOP ALGOL/COBOL,MIX=2, TOTAL OLAY RATE=25%

NOTE: OLAY RATE IS THE PERCENT OF CPU TIME.

THE FOLLOWING IS THE CPU, I/O, AND ELAPSED TIME FOR EACH JOB AT COMPLETION TIME:

		TIMES		
MIX	JOB	CPU	I-O	ELAPSED
1	ESPOL DISK	116 SEC	32 SEC	148 SEC
3	ESPOL DISK	119 SEC	32 SEC	149 SEC
2	ALGOL COBOL	113 SEC	37 SEC	264 SEC

NOTE: AUTO-STOPPED JOB WAS RESTARTED AFTER THE FIRST EOJ.

OLAYMAX = 25%

MIX	OLAY RATE	PRIORITY	TIME	CORE	SAVECORE
1	31%	5	72 SEC	5534 WDS	4015 WDS
2	41%	5	71 SEC	6151 WDS	3448 WDS
3	26%	5	69 SEC	2523 WDS	3840 WDS
SYSTEM	33%				

#AUTO-STOP ALGOL/COBOL MIX = 2

NOTE: OLAY RATE IS THE PERCENT OF CPU TIME.

THE FOLLOWING IS THE CPU, I/O, AND ELAPSED TIME FOR EACH JOB AT COMPLETION TIME:

MIX	JOB	TIME CPU	TIME I-O	TIME ELAPSED
1	ESPOL DISK	119 SEC	31 SEC	182 SEC
2	ESPOL DISK	122 SEC	30 SEC	183 SEC
3	ALGOL COBOL	119 SEC	31 SEC	289 SEC

NOTE: AUTO-STOPPED JOB WAS RESTARTED AFTER THE FIRST EOJ.

OLAYMAX = 30%
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MIX	OLAY RATE	PRIORITY	TIME	CORE	SAVECORE
1	27%	5	70 SEC	5623 WDS	3944 WDS
2	43%	5	69 SEC	5131 WDS	3715 WDS
3	32%	5	67 SEC	3133 WDS	3842 WDS
SYSTEM	34%				

#AUTO-STOP ALGOL/COBOL,MIX=2

NOTE: OLAY RATE IS THE PERCENT OF CPU TIME.

THE FOLLOWING IS THE CPU, I/O, AND ELAPSED TIME FOR EACH JOB AT COMPLETION TIME:

MIX	JOB	CPU	TIME I-O	ELAPSED
1	ESPOL DISK	119 SEC	30 SEC	179 SEC
3	ESPOL DISK	120 SEC	30 SEC	180 SEC
2	ALGOL COBOL	119 SEC	31 SEC	286 SEC

NOTE: AUTO-STOPPED JOB WAS RESTARTED AFTER THE FIRST EOJ.

OLAYMAX = 35%

MIX	OLAY RATE	PRIORITY	TIME	CORE	SAVECORE
1	32%	5	87 SEC	6760 WDS	3966 WDS
2	52%	5	86 SEC	4253 WDS	4433 WDS
3	31%	5	85 SEC	3041 WDS	3813 WDS
SYSTEM	37%				

#AUTO-STOP ALGOL/COBOL,MIX=2

NOTE: OLAY RATE IS THE PERCENT OF CPU TIME.

THE FOLLOWING IS THE CPU, I/O, AND ELASPED TIME FOR EACH JOB AT COMPLETION TIME:

MIX	JOB	CPU TIME	I-O TIME	ELAPSED
1	ESPOL DISK	122 SEC	31 SEC	194 SEC
3	ESPOL DISK	122 SEC	31 SEC	195 SEC
2	ALGOL COBOL	119 SEC	31 SEC	301 SEC

NOTE: AUTO-STOPPED JOB WAS RESTARTED AFTER THE FIRST EOJ.

OLAYMAX = 40%

MIX	OLAY RATE	PRIORITY	TIME	CORE	SAVECORE
1	34%	5	80 SEC	4508 WDS	4037 WDS
2	51%	5	78 SEC	5490 WDS	3751 WDS
3	38%	5	77 SEC	3408 WDS	3838 WDS
SYSTEM	40%				

#AUTO-STOP ALGOL/COBOL,MIX=2

NOTE: OLAY RATE IS THE PERCENT OF CPU TIME.

THE FOLLOWING IS THE CPU,I/O, AND ELAPSED TIME FOR EACH JOB AT COMPLETION TIME:

MIX	JOB	CPU TIME	I-O TIME	ELAPSED
1	ESPOL DISK	120 SEC	32 SEC	193 SEC
3	ESPOL DISK	121 SEC	31 SEC	194 SEC
2	ALGOL COBOL	117 SEC	31 SEC	297 SEC

NOTE: AUTO-STOPPED JOB WAS RESTARTED AFTER THE FIRST EOJ.

OLAYMAX = 45%

MIX	OLAY RATE	PRIORITY	TIME	CORE	SAVECORE
1	38%	5	133 SEC	5477 WDS	4027 WDS
2	73%	5	132 SEC	5752 WDS	3690 WDS
3	41%	5	131 SEC	2901 WDS	3885 WDS
SYSTEM	49%				

#AUTO-STOP ALGOL/COBOL, MIX=2

NOTE: OLAY RATE IS THE PERCENT OF CPU TIME.

THE FOLLOWING IS THE CPU, I/O, AND ELAPSED TIME FOR EACH JOB AT COMPLETION TIME:

MIX	JOB	TIME CPU	TIME I-O	TIME ELAPSED
1	ESPOL DISK	127 SEC	30 SEC	235 SEC
3	ESPOL DISK	127 SEC	30 SEC	236 SEC
2	ALGOL COBOL	121 SEC	31 SEC	335 SEC

NOTE: AUTO-STOPPED JOB WAS RESTARTED AFTER THE FIRST EOJ.

OLAYMAX = 50%

MIX	OLAY RATE	PRIORITY	TIME	CORE	SAVECORE
1	41%	5	238 SEC	5445 WDS	3946 WDS
2	76%	5	237 SEC	6656 WDS	3734 WDS
3	40%	5	236 SEC	2613 WDS	3820 WDS
SYSTEM	50%				

#AUTO-STOP ALGOL/COBOL, MIX=2

NOTE: OLAY RATE IS THE PERCENT OF CPU TIME.

THE FOLLOWING IS THE CPU, I/O, AND ELAPSED TIME FOR EACH JOB AT COMPLETION TIME:

MIX	JOB	CPU	TIME I-O	ELAPSED
1	ESPOL DISK	125 SEC	32 SEC	316 SEC
3	ESPOL DISK	128 SEC	31 SEC	317 SEC
2	ALGOL COBOL	125 SEC	31 SEC	396 SEC

NOTE: AUTO-STOPPED JOB WAS RESTARTED AFTER THE FIRST EOJ.

OLAYMAX = 60%

NO JOBS WERE AUTO-STOPPED WHEN THE OLAYMAX PARAMETER WAS SET TO 60%.

THE FOLLOWING IS THE CPU, I/O, AND ELAPSED TIME FOR EACH JOB AT COMPLETION TIME:

MIX	JOB	CPU	TIME I-O	ELAPSED
1	ESPOL DISK	134 SEC	33 SEC	469 SEC
3	ESPOL DISK	132 SEC	32 SEC	470 SEC
2	ALGOL COBOL	130 SEC	36 SEC	504 SEC

WORKSET NOT RUNNING - SERIAL EXECUTION

THE FOLLOWING IS THE CPU, I/O, AND ELAPSED TIME FOR EACH JOB AT COMPLETION TIME:

MIX	JOB	CPU	TIME I-O	ELAPSED
	ESPOL DISK	116 SEC	31 SEC	126 SEC
	ESPOL DISK	116 SEC	31 SEC	126 SEC
	ALGOL COBOL	114 SEC	35 SEC	130 SEC

TOTAL ELAPSED TIME IF RUN SERIALLY: 382 SECONDS

OLAY GRAPH

THE FOLLOWING GRAPH ILLUSTRATES THE EFFECT OF THE WORKING SET OLAYMAX VALUE ON THE TOTAL (ELAPSED) TIME REQUIRED TO RUN ALL THREE JOBS. AS THE OLAYMAX VALUE IS INCREASED, THE SYSTEM ALLOWS THE JOBS TO MULTIPROCESS FOR A LONGER PERIOD OF TIME BEFORE TAKING ACTION TO SUSPEND ONE OF THE JOBS.

FOR THIS PARTICULAR MIX, IT TAKES JUST AS LONG TO RUN THE JOBS TOGETHER AS IT DOES TO RUN THEM SERIALLY WHEN THE OLAYMAX VALUE IS SET TO APPROXIMATELY 50%. BELOW THIS VALUE, THE JOBS RUN TO COMPLETION FASTER THAN THEY WOULD IF RUN SERIALLY, AND ABOVE THIS VALUE, THE REVERSE IS TRUE.

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