PROJECT

IMPLEMENT A SIMULATOR IN PASCAL OF THE SIMPLE MULTIPROGRAMING OPERATING SYSTEM SPECIFIED BELOW. ALL SPECIFICATIONS ARE SUBJECT TO CHANGE AT ANY TIME.

HARDWARE:

5 USERS WITH NUMBERS: 1..5;3 CRT'S X, Y & Z; 1 I/O DEVICE FOR PROGRAM I/O, (FCFS); 1 CPU (THE 0.5 NANOCOMPUTER);1 DISK TO HOLD USER PROGRAMS: 8 TRACKS (0-7), 4 SECTORS (0-3)(BLOCKS) / TRACK, 4 PROGRAM LINES (0-3) PER BLOCK; 32 "PROGRAM LINES" OF EXECUTABLE MEMORY ARRANGED IN 8 FRAMES (0..7) OF 4 LINES EACH (0 -3).

PROGRAM FORM:

PROGRAM FILES WILL BE INPUT FROM THE TEXTFILE FILES AS NEEDED. THE THE GENERAL FORM OF A PROGRAM LINE IS "CHARACTER INTEGER" WITH THE FOLLOWING:

'C' VALUE : COMPUTE - THE VALUE IS THE AMOUNT OF CPU TIME NEEDED;
'I' VALUE : I/O - THE VALUE IS THE AMOUNT OF TIME NEEDED ON THE DEVICE;
'Z' NO VALUE : END OF FILE MARKER AND HALT INSTRUCTION;
'E' NO VALUE : END OF REPEAT LOOP;
'R' VALUE : START OF REPEAT LOOP, VALUE IS THE NUMBER OF TIMES TO GO THROUGH THE LOOP. (LOOPS MAY BE NESTED WITHIN LOOPS TO ANY LEVEL.);
'F' VALUE : BEGIN OF FILE - VALUE IS THE PROGRAM PRIORITY (0..7);

ZERO HAS THE HIGHEST PRIORITY. PROGRAM FILES ARE ENTERED ONTO THE DISK, AND FROM THE DISK TO MEMORY BY INTERACTIVE COMMANDS FROM THE CRT'S.

INTERACTIVE COMMANDS:

A LIST OF INTERACTIVE COMMANDS, THE EVENT LIST TO DRIVE THE SIMULATOR, IS ON THE INPUT TEXTFILE COMMAND. THE GENERAL FORM OF A COMMAND LINE IS "TIME CRTNUMBER COMMAND [PARAMETERS]" WITH THE FOLLOWING:

LOGON, USERNUMBER : CREATES A PROCESS.
CREATE, FILENAME : READS A FILE FROM FILES & LISTS DISK ADDRESS ASSIGNE
DELETE, FILENAME : FREES DISKSPACE
RUN, FILENAME : SPAWNS A NEW PROCESS
DIR, (LISTS THE USERS DIRECTORY)
LOGOFF, DESTROYS PROCESS CREATED BY LOGON
DISKSPACE, (LISTS THE NUMBER OF UNUSED DISK BLOCKS)
QUEUELINE, (LISTS THE NUMBER AND NAMES OF THE PROCESSES THAT ARE ON THE I/O QUEUE)
RENAME, OLDFILENAME, NEWFILENAME
ABORT, PROCESSNAME

ALL COMMANDS (INCLUDING INCORRECT COMMANDS) TAKE 2 TIME UNITS. DELIMITERS ACCEPTED ARE ' ',',',',':' AND EOLN. INCOMPLETE PARAMETERS LISTS ARE PROMPTED FOR THE ADDITIONAL PARAMETERS.

OUTPUT:

TWO TEXTFILES WILL BE USED FOR OUTPUT. TRACE WILL BE A LINE BY LIST OF THE EVENTS AS THEY HAPPEN. SCREENS WILL BE A PICTURE OF WHAT IS PRINTED ON THE THREE CRT'S. FORMATS:

TRACE: TIME USER_NUMBER PROCESS_NAME LINE_NUMBER MEMORY_ADDRESS EVENT
OR: TIME USER_NUMBER "CRT NAME" CRT_NAME EVENT
OR: TIME --> CPU IDLE
SCREENS: TIME SCREEN X SCREEN Y SCREEN Z

THE EVENTS OF INTEREST ARE: I/O REQUEST, I/O COMPLETION, PROGRAM LINE COMPLETION CPU IDLE, INTERACTIVE COMMAND COMPLETION, PROGRAM COMPLETION OR ABORTION, TIME SLICE EXPIRATION, JOB POOL ENTRY, AGING, AND PAGE FAULTS. TIME SHOULD NOT BE PRINTED IF TIME HAS NOT CHANGED SINCE THE LAST EVENT.

FUNCTIONAL DIVISION:

1 SUPERVISOR: CLOCK, CPU SCHEDULING, "THE CPU", EVENT DRIVER.
2 PROCESS MANAGER: CREATING, DELETING AND MAINTAINING PROCESSES.
3 MEMORY MANAGER: ALLOCATES PAGE FRAMES, MAINTAINS PAGE TABLES.
4 DEVICE MANAGER: MAINTAINS I/O DEVICE QUEUE, ETC.
5 FILE MANAGER: ALLOCATES DISK SPACE, MAINTAINS THE FILE SYSTEM.
6 COMMAND INTERPRETER: READS INTERACTIVE INPUT LINES, SCHEDULES
THE APPROPRIATE MANAGER AND WRITES SYSTEM RESPONSE.

NOTES:

READY QUEUE IS KEPT IN PRIORITY ORDER AND FCFS AMONG PROCESSES WITH
THE SAME PRIORITY.
COMMAND PROCESSES HAVE A PRIORITY OF 1.
TIME_SLICE = 45 TIME UNITS
PAGE FAULTS (DEMAND PAGING) TAKE 3 TIME UNITS. (ALSO FCFS)
AGING IS DONE EVERY 300 TIME UNITS.
TOTAL CPU TIME AND NUMBER OF PAGE FAULTS ARE PRINTED WITH THE
COMPLETION OR ABORTION OF A "PROGRAM" PROCESS.

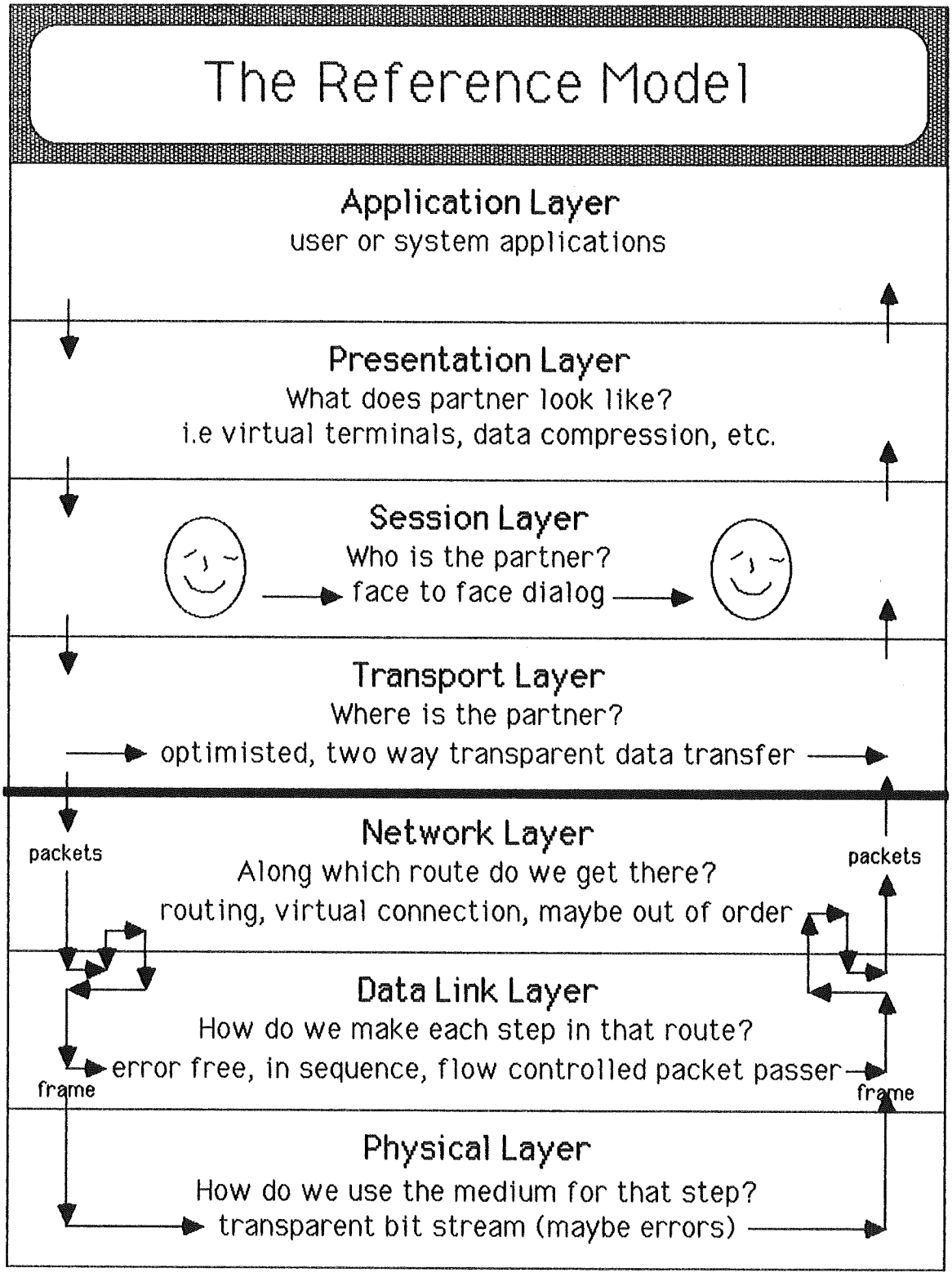
DUE_DATES:

PROGRAM DESIGN SPECIFICATION -- 19 OCT 1984
THE PROGRAM ITSELF -- 19 NOV 1984
THESE DATES ARE NOW AND FOREVER WRITTEN IN STONE!

GRADES:

CORRECTNESS, MODULAR DESIGN, READABILITY, DOCUMENTATION, TEAM EFFORT,
EACH TEAM WILL BE INTERVIEWED AFTER TURKEY DAY

GOOD LUCK ---> START NOW!


The Reference Model
Application Layer
user or system applications
Presentation Layer
What does partner look like?
i.e virtual terminals, data compression, etc.
Session Layer
Who is the partner?
face to face dialog
Transport Layer
Where is the partner?
optimisted, two way transparent data transfer
packets
Network Layer
Along which route do we get there?
routing, virtual connection, maybe out of order
packets
Data Link Layer
How do we make each step in that route?
error free, in sequence, flow controlled packet passer
frame
frame
Physical Layer
How do we use the medium for that step?
transparent bit stream (maybe errors)

The Bellenot's COP 4611 - 02 Intro to Op Sys
office 218 Love office hours 12:30-1:15 M-F
the good doctor is around most afternoon's

Text: Peterson & Silberschatz: Op Sys Concepts
Coverage: We will attempt to cover the entire text.

Software Project: 50% of your grade will be based on a team software project. This project will have multiple due dates and will be extensively outlined in class.

Tests: 1. A midterm (10% of grade) on
2. A final (30% of grade) on

Homework: Assigned weekly on Wed and due the next wed. Usually two problems often from the text. Grade on a 0-10 basis, only the top 90% count toward the 10% of your grade. The instructor will mark these according to neatness and clairity of expression as well as for correctness.

Grades: The classic 90, 80, 70, 60 for A, B, C, D modified by allowdy 68 for a C since it is a senoir level course.

HW1: due Wed 15 Jan 86 Probs 1.5, 1.11 pp35-36 Text.

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COP 4611 01 Operating Systems

Instructor Bellenot Off. 218 Love Off. hrs MWF 12:30-1:15
(but I'm around most afternoons)

Pre Requisites C or better in both
COP 3101 Prog. 2 and
COP 3402 Assem. Lang. Prog. (or anyother Assem. Lang)

Text Peterson & Silberschatz Operating System Concepts
(the one with dinosaurs, not the green one)
[will will do more or less the whole text, more or less in the text's order]

Grades A 90% B 80% C 68% D 60% (± for borderline)
based on 25% 1 Final 12:30pm 11 Dec
12.5% 1 Test Tentatively 31 Oct
12.5% n Quizzes The first 12 sept [Tent. Also 26 sept; 10, 24 Oct; 14, 28 Nov
50% Programing Project

Project: A team (groups of three) construction of an operating system simulation. Details and grading formula will be given later. Due Date 19 Nov at 1:00 pm. [In pascal]. [A written "Program Design Spec" Due (Tent) 26 Oct]

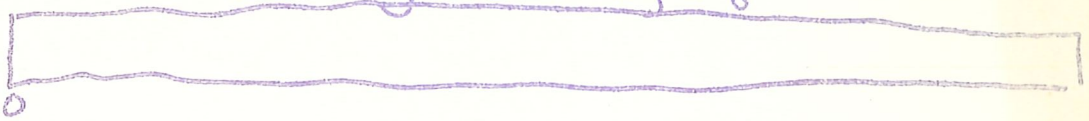
Homework No other written homework will be required, however it is to your advantage to do the problems on your own. Reading Assignments will be made from time to time.

Read Ch 1 & 2 by next time (Wed 29 Aug)
Ch 3 by 5 sept
Ch 4 by 14 sept

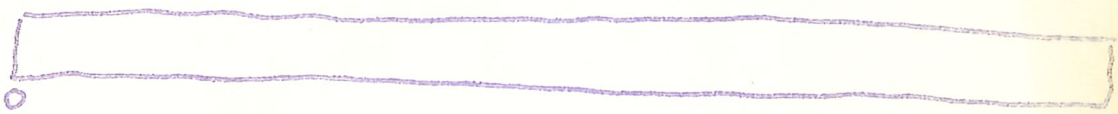
COP 4611-01 OP SYS Quiz 2 by _____

1 Job A (20 units) Job B (5 units) Job C (12 units) & Job D (8 units) arrive at time t=0 in the order A, B, C, D. Draw the Gantt chart for each of the following scheduling Algorithms below

1pt A) FCFS



1pt B) SJF



2pt C) Round Robin
Quantum time = 7

2pt D) Round Robin
Quantum time = 12

2. Compute the average wait time for each of 1
1pt A) 1pt B) 2pt C) 2pt D)

3 True or false (2 pts each)

A. A single level directory requires user 1's filenames to be distinct from user 2's filenames

B. Tree structured directories allow one user to have two distinct filenames for the same file

C. Tree structured directories allows one user to have two distinct files with the same filename

D. A link count is kept on each file in an acyclic graph directory to see how often the file is used

bellenot % fsucs % usfvax1 % usfvax2 % ucf-os % ucf-cgr % gatech.
csnet - relay. ARPA

Machine interface. Project Part 3.

Project up and running (by hook or by crook)

major subprojects
1. event manager or interrupt manager
2. boot loader and intialization
3. modifications to psource
4. integration (always major)

code directory
memory
msource - six new functions
memh - list of external functions
memd - "memdu" team2 still with errors

queue
qsource, qh, qd } unchanged

proc_OS
psource → Project-part-2.
ptroch - in plib
ptrocd → Project-part-2

hardware
hsource - hard7v, top, middle, bottom
hardh - on SCRI::
hardd - void.

event
esource - there but with stubbs
einclde - exists but in no Lib

boot - philosopher's test case. (updated)

subproject descriptions

2. boot loader: Takes the quasi assembly code in the file boot and loads it into memory starting at location zero
2. initialization: Includes the above and all file action. (Must be in the main program esource.)
3. process modifications: there is a clock now so the "timing part" of the pcb can be filled in. Also a context switcher. Changes to receive (and request?) see doreceive in "bottom". Addition of num of processes ~~running~~ existing not counting null & a call to panic when it drops to zero.

1. interrupts:
   a. timeslice timer ~ 50 – 100 cpuclocks
   b. clock ticks ~ every 20-25 cpuclocks
   c. rupt file (debug calls)
   d. input file (break points)

   priority highest d lowest a
4. adds & ends: finalization, dodebug, error catching

library responsibilities

The good doctor will control resource with the exception of middle – varma
The teams 0 & 2 will jointly control resource until such time that the code stablizes
The teams 0 & 2 will individually control their own copy of esource.

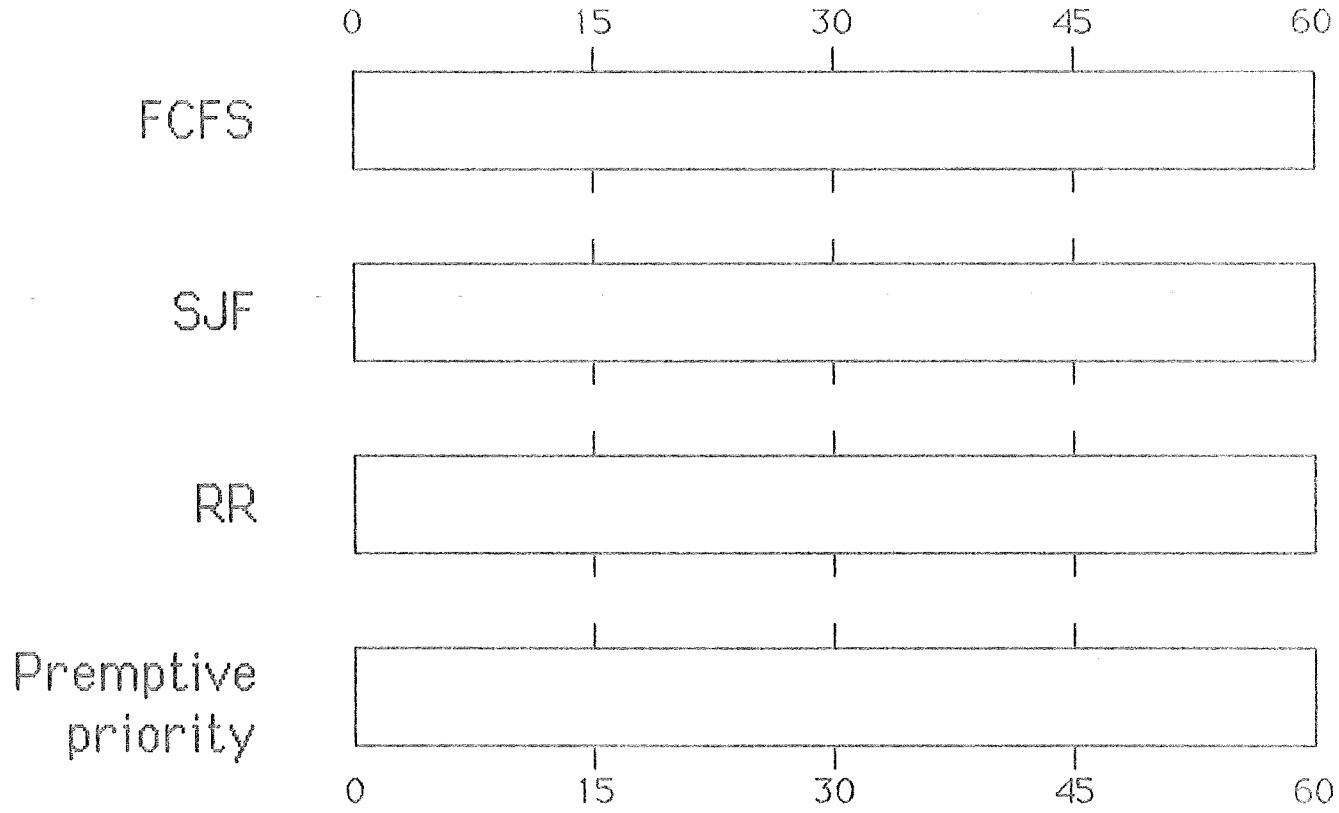
*1 worth 20pts 2 – 9 10 points each.

COP 4611 OPERATING SYSTEMS
SP 1986 FINAL

BY _____
SS# _____

JOB NAME	ARRIVAL TIME	SERVICE TIME	PRIORITY
A	0	15	2
B	3	8	1
C	9	12	3
D	15	20	4
E	20	5	3

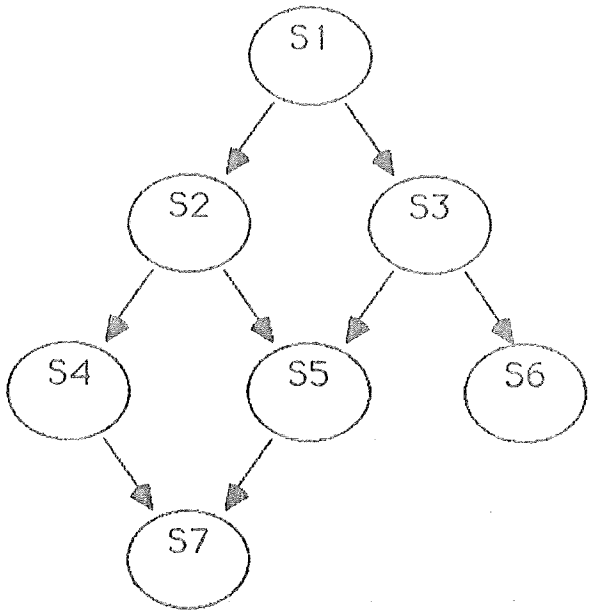
1. SCHEDULING: For each algorithm, complete the Gantt chart and the table below. (quantum = 10.)



WT=Wait Time, RT= Response Time

	FCFS		SJF		RR		premptive priority	
JOB	WT	RT	WT	RT	WT	RT	WT	RT
A								
B								
C								
D								
E								
Average								

2. Use both semaphores and the concurrent statement (together) to "express" the precedence graph to the right. Be sure to show the initial values of all semaphores.



3. Draw the preceedence graph for the following code. Lower case a, b, etc are semaphores initially zero and upper case A, B, etc are statement bodies, {} are groupings. Each capital letter should have its own circle as all the Si's above

```
parbegin
  { wait(a); wait(b); A; signal(c); B; signal(d); signal(d)}
  { wait(e); C; wait(c); D; signal(f)}
  { parbegin
      {E; signal(e); signal(g)}
      {F; signal(a)}
    parend}
  {G; signal(b); wait(d); H; wait(f); J}
  {wait(d); K; wait(g); wait(f)}
parend.
```

4. For each of the following methods of memory management discribe both
(i) How logical addresses are translated into physical addresses; and
(ii) How illegal addresses are found. Explicitly state what additional hardware you need.

A. Absolute addressing.

B. Base and Limit register addressing.

C. Paging.

5. Disk allocation can be done by either bit maps or linked lists. Explain each method. Suppose your disk contains 70M bytes arranged in 1K byte sectors. Compute the amount of overhead for each method (i.e. the space needed to hold the bit map or the links). Why must the bit map be on the disk and not in memory? Why is the linked list seldomed used?

6. What the four necessary conditions for deadlock? Explain the difference between deadlock prevention, deadlock avoidance and deadlock detection. For which of those three is banker's algorithm an example? Draw a resource allocation graph showing at least three processes in deadlock.

7. Define or explain:

A. Trojan horse.

B. Virtual/Transparent.

C. Tree structured directories.

8. The AB problem. Two kinds of processes, the A's and the B's, need to access a file "stuff". The A's and the B's can't share the file, but 2 A's can share the file or 3 B's can share the file. An incorrect solution to the AB problem is given below. Answer the following questions about this "solution": Can deadlock occur? Does it restrict the number of A's(B's) to at most two (three)? Does it provide for mutual exclusion between the A's and B's? If the semaphores are fair can starvation occur?

A type processes
wait (a_line)
do things with stuff
signal (a_line)

B type processes
wait (b_line)
do things with stuff
signal (b_line)

initially a_line = 2, b_line = 3.

9. Write a correct solution to the AB problem using semaphores. (If you are giving a "partially correct" solution – list its defficiencies)

A. Explain how a subversive train schedule made up by
(4pt) the Bolivian ~~driver~~ officials could block the ~~Bolivi~~ Peruvian train forever.

B. Explain why this unlimited blocking never occurred.
(4pt)

C. Explain why the two trains crashed one day.
(4pt)

Following the crash they change the use of the bowl. The Bolivian driver must wait at the entry until the bowl was empty, drive through the pass and walk back to put a ~~sto~~ pebble in the bowl. The Peruvian driver must wait at the entry until the bowl contains a pebble drive through the pass and walk back to remove the pebble. Prior to this arrangement, the Peruvian train ran twice a day and the Bolivian train ran once a day.

D. Explain why the Peruvians were unhappy with the new
(4pt) arrangement.

E. Using two bowls, devise an arrangement that avoids
(8pt) crashes and the problem in D.

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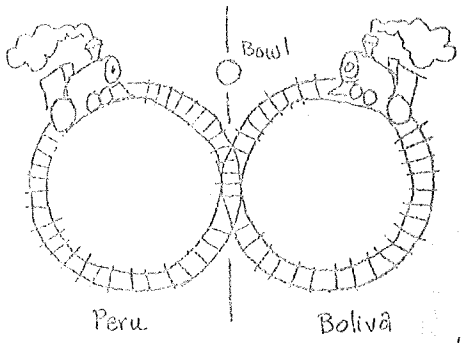
13. High in the Andes Mountains, there are two circular railroad lines. As shown in the diagram, one line is in Peru,



the other in Bolivia. They share a section of track, where the lines cross a mountain pass that lies on the international border. Unfortunately, the Peruvian and Bolivian trains occasionally collide when simultaneously entering the critical section of track (the mountain pass). The trouble is, alas, that the drivers of the two trains are BLIND and DEAF, so they can neither see nor hear each other.

The two drivers agree on the following method of preventing collisions. They set up a large bowl at the entrance to the pass. Before entering the pass, a driver must stop his train, walk over to the bowl, and reach into it to see if it contains a pebble. If the bowl is empty, the driver finds a pebble and drops it into the bowl, indicating that his train is entering the pass; once his train has cleared the pass, he must walk back to the bowl and remove his pebble, indicating that the pass is no longer being used. Finally he walks back to the train and continues down the line. If a driver arriving at the pass finds a pebble in the bowl, he leaves the pebble there; he repeatedly takes a siesta and re-checks the bowl until he finds it empty. Then he drops a pebble in the bowl and drives his train into the pass.

(MORE →)

FINAL
OS
F84

[illegible] ______

[illegible] ______

[illegible] ______

[illegible] mode: Next Scheduled Down Time 2:30 pm

[illegible] In A & B describe what the operations [illegible] value and queue of S

[illegible] (S):

[illegible] (S):

[illegible] What is the relationship between the value of S and the number of processes waiting in S's queue? [illegible]

[illegible] the following state transitions.

[illegible] → ready (5) running → ready

[illegible] → running (6) running → job-pool

[illegible] → suspended-ready (8) ready → job-pool

[illegible] → ready (10) suspended-ready → ready

[illegible] transitions are not allowed ______

[illegible] transitions are caused by interrupts ______

[illegible] term scheduler controls transitions ______

[illegible] term scheduler controls transitions ______

[illegible] controls transitions ______

[illegible] FIFO is almost always [illegible]

[illegible] FIFO [illegible]

[illegible] disadvantage to FIFO [illegible]

[illegible]

[illegible]

Job	Burst Time	Arrival Time
A	16	0
B	3	1
C	2	3

3. Tick T (True) or F (False) in the squares depending on the following structure and statements below

	A	B	C	D	E	F	G	H	I	J

A. Two different users can have a file named DATA.
B. A user can have two files named DATA
C. Each record field for each file
D. Requires garbage collection to clean up files that no longer have a directory reference.
E. [illegible]
F. Every file has at least one path name.
G. [illegible] can have one file named both DATA and ADA
H. [illegible]
I. [illegible]
J. [illegible]

6. Explain or Define: (3 ea)

A. Thrashing

B. Seek Time

C. Polling

D. Critical Section

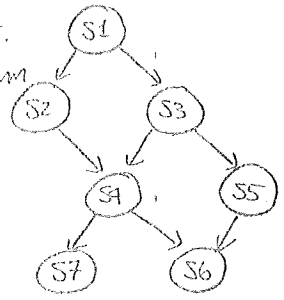
E. Token Passing

F. Transfer time

G. Working Set

H. Latency time

7. Consider precedence graph to the right. (10pt) Show how to write a corresponding program using semaphores and parbegin – parend. Initialize all semaphores.



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8. Compare & Contrast (4 pts ea)

A. Virtual vs Transparent

B. Deadlock vs Starvation

C. Local vs Global Page replacement

D. Segments vs Pages

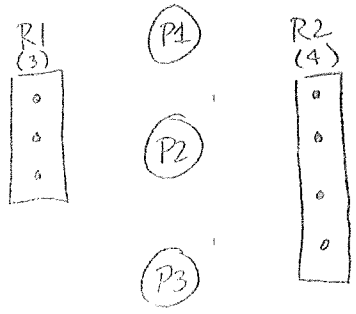
E. Absolute vs Relocatable

9. A (16pt) Complete the resource allocation graph from the info to right.

	ALLOC		REQU.		MAX	
	R1	R2	R1	R2	R1	R2
P1	1	1	1	0	3	1
P2	1	1	1	1	2	4
P3	0	1	0	1	0	3

B. Show that the system is not deadlocked. Give two sequences which processes can be completed.

C. Is the system safe or unsafe (in the sense of Banker's Algorithm)



D. One of the resources in R1 fails how does this change things?

E. Another process P4 enters the system, if the system was in a safe state before P4 entered can it change to an unsafe state? Why?

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10. Arithematic

(4pt) A. A tape records 1600 characters per inch and travels at 50 inches per second. This yields a transfer rate of one character per every _____ microseconds.

B. 80% of the memory references take 500 nanoseconds, 15% of the references take 200 microseconds, 4% take 1 millisecond and 1% take .025 seconds. The average access time is?

C. What % Utilization of the cpu is obtained if two process are both running (R,C,I,E like in the proj)?

A: R ∞, C 40, I 10, C
B: R ∞, I 40, C 20, E

_____

D. What % Utilization if just A is running? _____

What % Just B? _____

11. Page Replacement: (read whole problem before answering)

(15pt) A. There is a "best algorithm" called

B. But it impossible to use because...

C. However there is a good approximation called

D. But it isn't used either much because

E. The algorithm in C can be approximated by NRU (not recently used). Describe how this could be used like the "dirty bit"

12. General:

(10pt) A. What is the primary goal of a operating system for a user's view?

B. List (4) four properties/goals/responsibilities of an operating System implied by A.