The Open University of Sri Lanka
B.Sc. Degree Programme: LEVEL 05
Department of Mathematics and Computer Science
Final Examination 2012/2013
CPU3242 – OPERATING SYSTEMS
DURATION: Three Hours (3 hours)

Date: 28/05/2013 **Time: 1.00 pm – 4.00 pm**

Answer **FOUR** Questions **Only**

QUESTION 1

1.1) List **five (5)** activities of an operating system with respect to **process management**.

1.2) Define a *system call* in the context of an operating system.

1.3) List operating system functions in terms of system's view and programmer's view.

1.4) Describe **four** (4) events that would result in the creation of a process.

1.5) Draw a process state transition diagram of an operating system. Explain the terms *dispatch, timer run out, block* and *wakeup* using the process state transition diagram.

QUESTION 2

2.1) What is the *degree of multiprogramming* in an Operating System?

2.2) Write one approximation formula used to calculate the next CPU burst time for a process. Define each symbol used in the above formula.

2.3) Explain **two (2)** shortcomings of priority scheduling algorithms in the context of process scheduling.

2.4) Consider a system with one CPU and four jobs, Each job has an arrival time, a burst time and a priority as given below. *Priority* is ranked as 0 (lowest) and 127 (highest).

Job	Arrival Time	Burst Time	Priority
1	0	10	60
2	4	6	70
3	6	6	80
4	9	1	127

(i) For a non pre-emptive SJF scheduling algorithm (do not consider priority) draw a Gantt chart illustrating the jobs and compute the average waiting time. Show the calculations.

(ii) For a pre-emptive priority scheduling algorithm draw a Gantt chart illustrating the jobs and compute the average waiting time. Show the calculations.

(iii) Compute the average waiting times for Round Robin (RR) scheduling algorithm with time quanta of 4, 8 units.

(iv) Calculate the total number of context switches in the system for each of the two round robin time quanta stated in (iii) above.

QUESTION 3

3.1) Explain using an example a *race condition* in the context of concurrent processes.

3.2) Explain why the **message passing technique** is used in inter process communication. Discuss the characteristics of blocking and non blocking primitives used in the message passing technique.

3.3) Define a semaphore. Explain the problems that arise in semaphores when
(i) Function P is omitted
(ii) Function V is omitted

3.4) Write a pseudocode (c like code) for an algorithm to solve the *Producer Consumer problem* using semaphores.

QUESTION 4

4.1) Explain the solution used in thread management if parent thread terminates before the child thread.

4.2) Explain why multilevel page tables are used in operating systems.

4.3) Assume that the operating system on your computer uses the lazy buddy system for memory management. Initially the system has 2048 Kb of memory, which begins at address 0. Show the result of each request/release given below via successive figures.

A: Request 540K
B: Request 205K
C: Request 50K
D: Request 160K
Release A
E : Request 80K
Release B
Release D
Release C

4.4) Assuming that the system given in 4.3 has only completed up to the memory allocation request of D, compute the amount of internal fragmentation that exists in the system at that time.

QUESTION 5

5.1) List **four (4)** necessary and sufficient conditions for a dead lock to occur.

5.2) List **four (4)** methods used to recover from a deadlock.

5.3) In a System, there are a total of 16 units of resource R1, 9 units of resource R2 and 10 units of Resource R3. The system is in the following state (S0).

Process	Claim			Allocation		
	R1	R2	R3	R1	R2	R3
P0	4	2	2	2	2	1
P1	5	7	5	4	1	3
P2	4	6	4	3	1	2
P3	6	4	7	3	2	1

(i) Justify that the above state (S0) is a safe state. Give the complete sequence of jobs and calculations.

(ii) The process P2 requests for the resources (R1, R2, R3) equivalent to units (1, 2, 2) when the system is in state S0. Is it possible to grant the request by P2? Give a process sequence.

(iii) The process P3 requests for the resources (R1, R2, R3) equivalent to units (1, 1, 1) when the system is in state S0. Is it possible to grant the request by P3? Give a process sequence.

QUESTION 6

6.1) Compare *linked allocation* and *indexed allocation* in terms of file allocation methods in an operating system?

6.2) Consider the following page reference string. Assume no preparing occurs and three frames are allocated to a process. Use the FIFO page replacement algorithm.

1,0,3,1,0,4,2,0,4,1,2,3,2,0,5,1,0,4

(i) Show what pages are in the memory at each given time.
(ii) How many page faults would occur?

6.3) A 64-bit address is divided into a 10-bit segment number, a 10-bit page number and a 44-bit displacement.

(i) How many pages can a segment have?
(ii) What is the page size?
(iii) How many segments can be addressed?

6.4) Describe the working methodology of the following disk access scheduling schemes

(i) SCAN
(ii) C-LOOK