The Open University of Sri Lanka
B.Sc. Degree Programme : LEVEL 05
Department of Mathematics and Computer Science
Final Examination 2014/2015
CPU3242 – OPERATING SYSTEMS
DURATION: Three Hours (3 hours)

Date: 28/04/2015 **Time: 1.00pm – 4.00pm**

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

QUESTION 1

1.1) List **three (3)** objectives of an operating system.

1.2) List the operations carried out in the creation of a process.

1.3) What is the operation of the system call *fork* in an UNIX system?

1.4) Explain operating system functions in terms of programmer's view.

1.5) Process **P** has just started the execution in CPU at 0 ms and the processes **Q** and **R** are in the ready queue of the system. The process **S** arrives at the ready queue at 2ms. Burst times of **P, Q, R** and **S** processes are 4, 10, 3, 1 (in ms) respectively. Context switch time of the system is 1 ms and the scheduling algorithm is SJF with preemption. Stating all the assumptions you make,

(i) Calculate the total number of context switches in the system.

(ii) Calculate the turnaround time for the process **P** inclusive of context switch times.

QUESTION 2

2.1) What is *Process Control Block* in an operating system? List **five (5)** fields of the Process control block.

2.2) Explain **five (5)** factors affecting the scheduling decisions of an operating system.

2.3) Explain the difference between a *multilevel queue* and a *multilevel feedback queue* by drawing appropriate diagrams.

2.4) Consider a system with one CPU and five jobs. Each job has an arrival time, 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	5	60
2	3	7	70
3	5	6	80
4	7	1	100
5	10	4	127

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

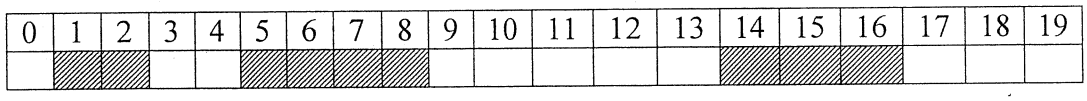
(ii) Draw a Gantt chart illustrating the jobs and compute the average waiting time using the pre-emptive priority scheduling algorithm. Show the calculations.

QUESTION 3

3.1) Define the *critical section problem* in the context of concurrent processes.

3.2) Write a pseudo code (c like code) to solve the *Producer Consumer problem* using monitors.

3.3) The memory allocation of a system is given below. Allocated partitions are shaded and the partition numbering starts with 0. The system uses the linked list based memory management.



List the areas of the memory holes and the areas occupied by the processes in the standard notation.

3.4) A 36 bit address is divided into a 16-bit segment number, 12-bit page number and 8-bit displacement.

(i) How many pages can a segment have?

(ii) What is the page size?

(iii) How many segments can be addressed?

QUESTION 4

4.1) List the similarities and differences between threads and processes.

4.2) Describe the **three (3)** types of threading models used in an operating system using suitable diagrams.

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

A: Request 140K
B: Request 68K
C: Request 80K
D: Request 200K
Release A
E: Request 60K
Release B
Release D
Release C
Release E

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

QUESTION 5

5.1) List **two (2)** methods of handling a deadlock?

5.2) Explain *Dijkstra's Banker's Algorithm* using an appropriate example.

5.3) In a System, there are a total of 15 units of the resource R1, 7 units of the resource R2 and 10 units of the resource R3. The system is in the following state (S0).

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

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

(ii) The process P2 requests for the resources (R1,R2,R3) equivalent to units (2,0,1) when the system is in state S0. Is it possible to grant the request by P2? Give process sequence.

QUESTION 6

6.1) Explain the terms *page fault* and *thrashing* ?

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

0,1,6,1,0,1,2,0,1,2,3,1,2,6,7,0,3,1,0,3

(i) Show what pages are in memory at each given time.

(ii) How many page faults would occur?

6.3) Explain the following file space allocation methods using proper diagrams

(i) Linked Allocation

(ii) Indexed Allocation

6.4) Describe the functionality of the following disk access scheduling schemes

(i) C-SCAN

(ii) LOOK