The Open University of Sri Lanka
B.Sc. Degree Programme : LEVEL 05
Department of Computer Science
Final Examination 2019/2020
CPU3242 – OPERATING SYSTEMS
DURATION: Three Hours (3 hours)

Date: 17/01/2020 **Time: 9.30am – 12.30pm**

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

QUESTION 1

1.1) What is the *privileged state* in an operating system ?

1.2) Draw a diagram to show an abstraction of computer system components.

1.3) Explain **five (5) operating system functions** in terms of programmer's view.

1.4) Process **P** has just started the execution in CPU at 0 ms and the processes **Q** and **R** arrive at 1 ms to the ready queue of the system. The process **S** arrives at the ready queue at 4 ms. Burst times of **P, Q, R** and **S** processes are 6, 4, 3, 1 (in ms) respectively. Context switch time of the system is 2 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

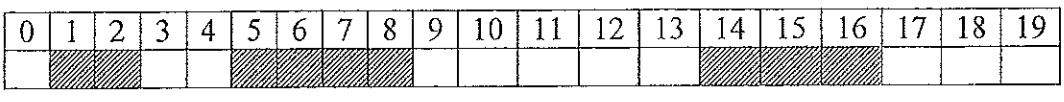
2.1) Explain **four (4)** reasons to have cooperating processes.

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

2.3) Explain **three (3)** characteristics of message passing primitives.

2.4) Write an algorithm to solve the *produce consumer problem* using semaphores.

2.5) 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.

QUESTION 3

3.1) List the **five (5)** major activities of an operating system with regard to process management.

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

3.3) Define the difference between *pre-emptive* and *non-pre-emptive* scheduling.

3.4) 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	8	60
2	3	7	50
3	5	4	40
4	7	1	100
5	10	1	127

(i) Draw a Gantt chart illustrating the jobs using the pre-emptive SJF scheduling algorithm. Then compute the turnaround time, average waiting time and average response time. Show all 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 all the calculations.

QUESTION 4

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

4.2) Suppose you have A_{5x4} and B_{4x8} matrices to be multiplied. At most, how many threads are needed to do the A x B matrix multiplication? Justify your answer.

4.3) Explain the terms *coalescing* and *thrashing* used in memory management.

4.4) Draw a diagram that describes combined approach of paging and segmentation.

4.5) Consider the following page reference string. Assume that there are no preparing occurs and three frames are allocated to process. Use the LFU page replacement algorithm.

2,1,3,4,2,1,3,4,2,1,3,4,5,6,7,8

(i) Show what pages are in memory at a given time using a table.

(ii) How many page faults would occur?

QUESTION 5

5.1) List **four (4)** approaches that can be used to recover from a deadlock?

5.2) Explain **four (4)** necessary and sufficient conditions required for a deadlock to occur?

5.2) Explain the *Dijkstra's Banker's Algorithm.* (Hint: use Available, Claim, Allocation and Require matrices in your explanation).

5.3) In a System, there are a total of 16 units of the resource R1, 9 units of the resource R2 and 12 units of the resource R3. The system is in the following state (S0).

Process	Max			Allocation		
	R1	R2	R3	R1	R2	R3
P0	5	2	6	1	2	3
P1	3	5	7	2	2	4
P2	6	8	2	4	1	1
P3	7	5	3	3	3	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 (1,0,1) when the system is in state S0. Is it possible to grant the request by P2? Give process sequence.

QUESTION 6

6.1) List the different operations that can be performed on a file.

6.2) Explain the following Input / Output (I/O) techniques

(i) Programmed I/O

(ii) Interrupt Driven I/O

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

(i) SCAN (ii) C-LOOK

(iii) FCFS (iv) SSTF

6.4) The performance of a file system depends upon the cache hit rate (fraction of blocks found in the cache). It takes 3 ms to satisfy a request from the cache, and 40 ms to satisfy a request, when a disk read is needed.

(i) Give a formula for the mean time required to satisfy a request if the hit rate is H.

(ii) Plot this function for values of H from 0 to 1.0 in increments of 0.2