EASTERN UNIVERSITY SRI LANKA

DEPARTMENT OF MATHEMATICS

SECOND EXAMINATION IN SCIENCE- 2015/2016

FIRST SEMESTER (Dec. /Jan., 2018)

CS 202- OPERATING SYSTEMS

Answer all questions — Time Allowed: 02 hours

01.

a) Briefly state why do we need an operating system in computers. [25 marks]

b) What is meant by a Critical Section? Briefly explain why is it important to have a critical section in each process. [25 marks]

c) A semaphore is a process synchronization tool. Describe briefly the operation of ***wait(s)*** and ***signal(s)*** on a semaphore **'s'**. [20 marks]

d) Explain how a semaphore can be used to solve the Bounded Buffer problem in process synchronization. You may use the given skeleton of producer and consumer processes. State the names and initial values of the semaphores used in your solution. [30 marks]

```
Producer()
do {
        ...
    produce an item
        ...
    wait(------------);
    wait(------------);
        ...
    add item to buffer
        ...
    signal(----------);
    signal(----------);
} while (TRUE);
```

```
Consumer()
do {
    wait(-------------)
    wait(-------------);
        ...
    remove item from buffer
        ...
    signal(-----------);
    signal(-----------);
        ...
    consume the item
        ...
} while (TRUE);
```

02.

a) What is pre-emptive and non-preemptive scheduling in terms of process scheduling? [20 marks]

b) Describe briefly the context switching and discuss the overheads involved in context switching of processes. [20 marks]

c) Explain briefly the First Come First Serve (FCFS) scheduling algorithm. [20 marks]

d) Consider the following set of processes, with the length of the CPU-burst time and arrival time given in ms.:

Process	Arrival Time	Burst Time
P1	0	3
P2	2	6
P3	4	4
P4	6	5
P5	8	2

i) Draw the Gantt chart illustrating the execution of the processes using First Come First Serve (FCFS) and Round Robin (RR, time quantum=2) scheduling. [20 marks]

ii) Calculate the waiting time and turnaround time for each scheduling algorithm. [20 marks]

03.

a) What is memory fragmentation? Write the difference between internal and external fragmentation. [20 marks]

b) The buddy system is a memory management scheme that uses variable sized partitions.

i) State the basic principle behind the buddy system. [20 marks]

ii) Assume a computer with a memory size of 256K, initially empty. Requests are received for blocks of memory of 5K, 25K, 35K and 20K. Show how the buddy system would deal with each request, showing the memory layout at each stage and the status of the lists at the end. [40 marks]

iii) After allocating all the processes, what would be the effect if the 25K process terminate and returning back to its memory location? [10 marks]

iv) What would be the effect if the 5K process terminate and returning back to its memory location? [10 marks]

04.

a) What is deadlock? What are the necessary conditions needed for a deadlock to occur?

[20 marks]

b) Describe the Safe, Unsafe, and Deadlock state spaces in terms of a process in execution.

[15 marks]

c) Consider the following system snapshot using data structures in the Banker's algorithm, with resources A, B, C, and D, and process P0 to P4:

Process	Max	Allocation	Need	Available
	A B C D	A B C D	A B C D	A B C D
P0	6 0 1 2	4 0 0 1		
P1	1 7 5 0	1 1 0 0		
P2	2 3 5 6	1 2 5 4		
P3	1 6 5 3	0 6 3 3		
P4	1 6 5 6	0 2 1 2		
				3 2 1 1

Using Banker's algorithm, answer the following questions:

i) How many resource instances of type A, B, C, and D are there in the system?

[10 marks]

ii) What are the contents of the Need matrix? [10 marks]

iii) Is the system in a safe state? [25 marks]

iv) If a request from process P4 arrives for additional resources of (1, 2, 0, 0,), can the Banker's algorithm grant the request immediately? If yes, Show the new system state and the safe sequence. [20 marks]