BACHELOR OF COMPUTER SCIENCE (GENERAL) DEGREE LEVEL II (SEMESTER I) EXAMINATION – JUNE/ JULY 2015

COURSE UNIT : CSC2133 - Operating Systems   Time: 2 hours

Answer ALL questions.

1.

    a.

        i. List four (04) benefits of using threads in Operating Systems.

        ii. Name and briefly explain three (03) requirements that a solution to the critical section problem must satisfy.

    b. A set of processes, their arrival times and the burst times are given in the following Table 01. Use the table to answer the questions.

Process	Arrival Time (ms)	Burst Time (ms)
P_1	0	5
P_2	1	15
P_3	3	12
P_4	7	25
P_5	10	5

Table 01

        i. Draw a Gantt chart to depict the scheduling under *First Come First Serve* scheduling algorithm.

        ii. Find the average waiting time and average turnaround time under preemptive *First Come First Serve* scheduling algorithm.

        iii. Draw a Gantt chart to depict the scheduling under preemptive *Shortest Job First* scheduling algorithm.

    c. Give two advantages (02) and two (02) disadvantages of *First Come First Serve* scheduling algorithm as compared to *Shortest Job First* scheduling.

    d. *Multilevel Feedback Queue Scheduling* is a fairly good, general CPU scheduling algorithm that can lead to starvation under certain circumstances.

        i. Briefly describe how starvation can occur when *Multilevel Feedback Queue Scheduling* is used.

        ii. Suggest a method to modify *Multilevel Feedback Queue Scheduling* so that starvation can be avoided.

2.

a. What is an Operating System? List four (04) typical functions of Operating Systems.

b. Give three (03) possible outputs of the following program.

```c
#include <stdio.h>

main()  {
    printf("10\n");
    if(fork())
        printf("2\n");
    else
        printf("3\n");
    printf("4\n");
    return 0;
}
```

c.
  i. Name four (04) file attributes of a File System in an Operating System.

  ii. Name three (03) file allocation methods used in File Systems and briefly state the use of them.

d. An i-node based file system uses data blocks of size 512 bytes. Suppose that each i-node contains 16 direct blocks with one single, double and triple indirection each. Disk block numbers can be stored in 4 bytes.

  i. What is the maximum file size allowed by the file system explained above?

  ii. If a file in the system has to use up to the double indirect pointer to store the data, what is the minimum size of the file?

  iii. Given that the maximum file size of combination of direct, single indirection, double indirection, and triple indirection in an i-node based file system is approximately the same as a file system solely using triple indirection. What are the reasons not to use only triple indirection to locate all file blocks?

3.

a.
  i. Name four (04) main registers located in an I/O port.

  ii. Name three (03) input/ output device types and briefly explain the behavior of them.

b. Consider a logical address space of 32 pages of 2048 addressable words each, mapped onto a physical memory of 32 frames.

    i.   How many bits exist in the logical address?

    ii.   How many bits are needed to signify the page number?

    iii. How many bits exist in the physical address?

    iv. What is the size of physical address space?

c. Consider the following page reference string:

A, B, C, D, B, A, E, F, B, A

If a process is allocated 04 physical frames respectively how many page faults would occur if page replacements are done using following algorithms? Show the steps.

    i.   FIFO

    ii.   Optimal page replacement

d. State two (02) differences between segmentation and paging. Explain why paging is faster than segmentation.

4.

  a.

    i. List four (04) reasons for having cooperating processes in a system.

    ii. Name three (03) process scheduling queues and explain the use of them in brief.

b. A system is with three (03) resource types R_1 (2 instances), R_2 (3 instances) and R_3 (1 instance). Three (03) processes P_1, P_2 and P_3 holds and wait for the resources as follows.

- P_1 is holding an instance of R_2, and waiting for an instance of R_1
- P_2 is holding an instance of R_1 and R_2, and is waiting for an instance of R_3
- P_3 is holding an instance of R_3

Draw a resource allocation graph for the above scenario.

c. A system has five (05) processes from P_0 to P_4 with A, B, C, and D four (04) resource types. The allocation, the maximum resources required by the processes to complete and the available resources are given in the Table 02. Use the Banker's Algorithm to answer the questions.

	Allocated				Maximum				Need				Available			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Process P_0	4	0	0	1	6	0	1	2								
Process P_1	1	1	0	0	1	7	5	0								
Process P_2	1	2	5	4	2	3	5	6								
Process P_3	0	6	3	3	1	6	5	3								
Process P_4	0	2	1	2	1	6	5	6								
													3	2	1	1

Table 02

i) What is the total number of resources of type A, B, C, and D exist in the system?

ii) Fill the **Need** column of the Table 02.

iii) Show that the system is in a safe state. You must show a possible sequence which satisfies the safety criteria.

iv) If P_2 requests (1, 0, 0, 1), state whether you can grant it or not. Justify your answer.

d. Describe the general strategy behind deadlock prevention, giving an example of a practical deadlock prevention method.

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