This question paper contains 7 printed pages]

Roll No. ☐☐☐☐☐☐☐☐☐☐

S. No. of Question Paper : **2047**

Unique Paper Code : **32341302** GC-3

Name of the Paper : **C-2 Operating Systems**

Name of the Course : **B.Sc. (H) Computer Science (CBCS)**

Semester : **III**

Duration : **3 Hours** Maximum Marks : **75**

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

Question No. **1** is compulsory.

Attempt any *four* questions out of the questions from

Question No. **2** to Question No. **6.**

Parts of a question must be answered together.

1. (*a*) Give *one* word answers for the following : 6×0.5=3

(*i*) In this address binding scheme the logical and physical addresses are same.

(*ii*) Time taken by the disk arm to reach the appropriate cylinder.

(*iii*) The scheduler responsible for transition of a process state from ready to running.

(*iv*) Fragmentation that occurs when there is enough space in main memory but is not contiguous.

(*v*) The in-memory strucutre that stores the information about all the files which are opened in the system.

(*vi*) Privileged instructions can execute in this mode.

P.T.O.

(b)  What will be the output of the following code segment ? Justify your answer :     3

```
int i;

cout<<"Hello"<<endl;

for (i=1; i<3; i++)

    fork();

cout<<"Over"<<endl;
```

(c)  Consider the following memory address references :

0345, 0312, 0347, 0732, 0679, 0732, 0642, 0478, 0425, 0324, 0368, 0841, 0974

What will the reference string corresponding to the addresses given above (assuming page size is 200 bytes) ? How many page faults will occur with this reference string assuming that the process can have only one frame ?     3

(d)  Differentiate between the following :     3×2=6

(i)  Tree structured Directories and Acyclic-Graph directories

(ii)  Asynchronous and Deferred cancellation of threads

(iii)  Peer-to-peer and client server computing.

(e)  What is the difference between the following two cases ?     2

Case 1 : copying a file.

Case 2 : sharing a file through linking.

(f)　Consider the following segment table :

| Segment | Base | Lenght |
|---------|------|--------|
| 0 | 219 | 600 |
| 1 | 1300 | 95 |
| 2 | 90 | 400 |
| 3 | 1327 | 480 |
| 4 | 1052 | 196 |

What are the physical addresses for the following logical addresses ?

(i)　0, 230

(ii)　1, 110.　　　　　　　　　　　　　　　　　　2

(g)　If the total number of frames in main memory is 80 and there are 4 processes in the system with the demand as 40, 20, 90 and 50 frames, respectively. What will be the number of frames allocated using the following allocation strategies ?

(i)　equal allocation　　　　　　　　　　　　　　1

(ii)　Proportional allocation.　　　　　　　　　　2

(h)　Can use of semaphores lead to deadlocks ? Justify your answer.　　　2

(i)　What are the three methods to pass parameters to the operating system ?　　　3

(j) Briefly explain the microkernel approach to operating system design. 2

(k) What are the advantages of multiprocessor systems ? 3

(l) How UNIX maintains the access control list for a file protection ? 3

2. (a) Consider the following set of processes, with the length of CPU burst time given in milliseconds :

| Process | Arrival Time | Burst Time | Priority |
|---------|--------------|------------|----------|
| $P_1$ | 0 | 4 | 2 |
| $P_2$ | 2 | 5 | 1 |
| $P_3$ | 5 | 7 | 3 |
| $P_4$ | 6 | 6 | 4 (Highest) |

(i) Draw Gantt chart for Shortest Job First algorithm and calculate turnaround time for every process.

(ii) Draw Gantt chart for Priority based (preemptive) algorithm and calculate waiting time for every process. 6

(b) Suppose there is a system with 128 KB of memory with no memory initially allocated. Given the following sequence of requests by the processes, show the memory layout at intermediate stages for best-fit allocation algorithm. 4

| Process Number | Nature of Request | Amount of memory requested (in KB) |
|---|---|---|
| P0 | Allocation | 40 |
| P1 | Allocation | 15 |
| P2 | Allocation | 10 |
| P3 | Allocation | 25 |
| P0 | Deallocation | |
| P2 | Deallocation | |
| P4 | Allocation | 18 |
| P5 | Allocation | 15 |

3. (a) Consider the following scenario :

Process P1 is waiting for resource R1 and using (holding) R2

Process P2 is using R1

Process P3 is using R1 and waiting for R2

Process P4 is using R2

(i) Draw the resource allocation graph. 3

(ii) Is the system in a deadlock ? If the answer is yes, then mention the processes in the deadlock else identify the sequence in which the processes can execute. 2

(b) Discuss the linked allocation of files and its variant FAT. 5

4. (*a*) The concurrent processes P1 and P2 execute the following code segments in a uniprocessor environment :

P1 : x=x+1

P2 : x=x−1

where x is a shared variable. What would be the problem of such concurrent execution ?                    4

(*b*) Consider the following page reference string :

7, 2, 3, 1, 2, 5, 3, 4, 6, 7, 7, 1, 0, 0, 4, 2, 0, 1, 7.

How many page faults would occur with LRU and optimal page replacement algorithms assuming four frames ? All frames are initially empty.                    6

5. (*a*) Consider a logical address space of 64 pages with 1-KB frame size mapped onto a physical memory of 128 KB :

(*i*) How many bits are there in the logical and physical addresses ?                    2

(*ii*) How what is the breakup of offset and page number in the logical address ? 2

(*iii*) How is the maximum number of entries in the conventional page table and in the inverted page table ?                    2

(*b*) Which of the following components of a program state are shared across different threads in a multithreaded process and why ?                    4

(*i*) global variables

(*ii*)   stack memory

(*iii*)  registers values

(*iv*)  files.

6.   (*a*)   Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order is :

86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130.

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk-scheduling algorithms :

(*i*)   SSTF

(*ii*)  SCAN.                                                        3+2

(*b*)   Draw the process state diagram and explain its various states.                5