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3rd Year 1st Semester B.Sc. (Engg.) Final Examination 2023

Course Title: Operating System — Time: 3 hours
Course Code: ICT 3109 — Marks: 70

Answer any 05 (FIVE) questions

1. a) Define the operating system. List a few different operating systems. Explain the main purpose of an operating system — 5
   b) What are the benefits of a multiprocessor system? — 2
   c) What is the Batch Operating System? What are the benefits and disadvantages of a Batch Operating System? — 4
   d) What is spooling in OS? What is the difference between Kernel and OS? — 3

2. a) Define process. Describe process state with appropriate figure. — 5
   b) "Kernel mode is called privilege mode" – explain this fallacy. — 4
   c) Explain process control block (PCB) with diagram. — 5

3. a) Differentiate preemptive and non-preemptive scheduling. In which CPU scheduling algorithm convey effect occurs. By which algorithm we can solve it. — 4
   b) Consider the following table for a uniprocessor system: — 10

Process ID	Arrival Time (μs)	CPU Time (μs)	Priority
P1	4	5	2
P2	6	6	3
P3	3	4	4
P4	0	3	5
P5	1	3	6
P6	2	4	7

By implementing SRTF/Priority (Preemptive) (In the priority column higher number higher priority is), HRRN, RR (time quantum tq= 1 μs, Here 1 μs = 1×10^{-6} sec)
(i) Sketch the respective Gantt chart for each above-mentioned algorithm.
(ii) Determine average waiting time, response time, turnaround time, and throughput.
(iii) Comments on results.

4 a) What is `fork();` ? How many children and parents will be produced for the following segment of C code? Explain briefly. — 4

(i)

```
#include<stdio.h>
#include<unistd.h>
int main()
{
    fork();
    printf ("ICT\n");
    return 0;
}
```

(ii)

```
#include<stdio.h>
#include<unistd.h>
int main()
{
    fork();
    fork ();
    printf ("MBSTU\n");
    return 0;
}
```

4. b) What is a semaphore? What is the difference between binary semaphores and counting semaphores? 6

c) Describe critical section problem. Explain the steps of addressing this issue.

5. a) Explain the concept of demand paging and its advantages. 4

b) How many types of fragmentation occur in the Operating System? Explain Internal and External fragmentations. 5

c) A 512MB block of memory is allocated using the buddy system. Demonstrate the results of the following sequence of requests and releases using figures: 3
Request A: 14MB; Request B: 52MB; Request C: 112MB; Release A; Request D: 63MB; Release C; Release B; Release D.

d) Why Linux is more secure than Windows operating system? 2

6. a) Consider the following system:

Process	Allocation				Max				Total Resources			
	A	B	C	D	A	B	C	D	A	B	C	D
P1	0	0	1	2	0	0	1	2	1	5	2	0
P2	1	0	0	0	1	7	5	0				
P3	1	3	5	4	2	3	5	6				
P4	0	6	3	2	0	6	5	2				
P5	0	0	1	4	0	6	5	6				

(i) Find the need matrix. 2

(ii) Is the system being safe? If safe, then find the safe sequence. 2

(iii) What will happen if process P1 requests one additional instance of resource type A and two instances of resource type C? 2

b) What are the four necessary and sufficient conditions behind the deadlock? 3

c) Consider a system consisting of four resources (R1, R2, R3, and R4) and three processes (P1, P2, and P3). R1 consists of 1 instance, R2 consists of 2 instances, R3 consists of 3 instances, R4 consists of 3 instances. Here, P1 requests for R1, P2 requests for R3, P3 requests for R2, R2 is held by P1, R2 is held by P2, R1 is held by P2, and R3 is held by P3.

(i) Draw the resource allocation graph for the above system. 3

(ii) Find out if there is any deadlock in the above system. Justify your answer. 2

7. a) For a system memory partitions and process size are placed in tabular form. Apply the First fit, Best fit, and Worst fit Dynamic algorithm and show how would they be placed in memory portions. 5

Memory partitions (in order) (KB)	Process size (in order) (KB)
75	Process **P1** = 212
760	Process **P2** = 470
225	Process **P3** = 150
350	Process **P4** = 115
120	Process **P5** = 436
175	
550	

7. b) Considering the segment table. 4

Segment Base	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96
5	456	568

What are the physical addresses for the following logical addresses?

(i) 0,430
(ii) 1,10
(iii) 2,500
(iv) 3,400
(v) 4,112
(vi) f. 5,12

c) Consider the following sequence of page references: 5

A B C D E C D A F I H G H I G H I E D E D B

(i) Apply the two-page replacement algorithms (using three frames), such as, Least Recently Used (LRU), and CLOCK to trace the page references.
(ii) Construct a performance analysis graph and determine which algorithm is the best.

8. a) Suppose that a disk drive has 5,000 cylinders numbered 0 to 4999. The drive is currently serving a request at cylinder 2150, and the previous request was at cylinder 1805. The queue of pending requests, in FIFO order, is: 6 4 5

2069, 1212, 2296, 2800, 544, 1618, 356, 1523, 4965, 3681

Starting from the current head position, what 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) LOOK
(iii) C-SCAN

5

b) Consider a typical disk that rotates at 30000 RPM and has a transfer rate of 25 x 10^6 bytes/sec. If the average seek time of the disk is twice the average rotational delay and the controller's transfer time is 10 times the disk transfer time, 8

(i) Calculate the average seek time.
(ii) Calculate the average rotational delay.
(iii) What is the average time (in milliseconds) to read or write a 256-byte sector of the disk?
(iv) Calculate the controller's transfer time.