KATHMANDU UNIVERSITY
End Semester Examination
June/July, 2023

Marks Scored:

Level : B.Sc.
Year : III

Course : COMP 307
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 16 JUL 2023

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Mark [X] the most appropriate answer.

1. What do you mean by booting in the operating system?
   [ ] The process of loading the operating system into memory
   [ ] The process of shutting down the computer
   [ ] The process of starting up the computer
   [ ] The process of creating a new file

2. Which of the following is a time-sharing operating system?
   [ ] Single-user, single-tasking operating system
   [ ] Single-user, multi-tasking operating system
   [ ] Multi-user, single-tasking operating system
   [ ] Multi-user, multi-tasking operating system

3. Which of the following is **NOT** a system call?
   [ ] fork ( ) [ ] exec( ) [ ] malloc( ) [ ] read( )

4. A process control block (PCB) contains which of the following information?
   a. The process's address space
   b. The process's priority
   c. The process's state
   [ ] a &b [ ] a & c [ ] b & c [ ] a, b &c

5. What is a critical section in the context of process synchronization?
   [ ] A section of code where shared resources are accessed
   [ ] A process that has the highest priority in the system
   [ ] A section of code where deadlock may occur
   [ ] A method used to allocate system resources to different processes

6. Which of the following statements is/are **TRUE**?
   a. Shortest remaining time first scheduling may cause starvation
   b. Preemptive scheduling may cause starvation
   c. Round robin is better than FCFS in terms of response time
   [ ] a only [ ] a & c [ ] b & c [ ] a, b &c

7. In the context of deadlock detection, what is a resource allocation graph used for?
[ ] To determine the maximum number of resources a system can allocate
[ ] To track the resources allocated to each process and the relationships between them
[ ] To determine the number of resources a process needs to complete execution
[ ] To track the arrival and departure times of processes

8. Which of the following is an example of a resource that can lead to deadlocks?
a. CPU cycles b. Main memory c. Input/output devices
[ ] c only [ ] a & c [ ] b & c [ ] a, b &c

9. The base register is also known as the .....
[ ] basic register [ ] regular register
[ ] relocation register [ ] delocation register

10. External fragmentation will occur when?
a. First fit is used b. Best fit is used c. Worst fit is used
[ ] a only [ ] b only [ ] c only [ ] a, b &c

11. Consider the following segment table:

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

What is the physical address for logical address (1, 15)?
[ ] Addressing error [ ] 2315
[ ] 2314 [ ] 2300

12. Which of the following is a goal of page replacement algorithms?
[ ] To allocate pages evenly among processes
[ ] To minimize disk I/O
[ ] To reduce the number of processes in the system
[ ] To maximize CPU utilization

13. The algorithm in which we allocate memory to each process according to its size is known as.....
[ ] proportional allocation algorithm [ ] equal allocation algorithm
[ ] split allocation algorithm [ ] priority allocation algorithm

14. What action does the page fault handler take when a page fault occurs?
a. Deallocates a page from the main memory
b. Allocates a new page in the main memory
c. Fetches the required page from secondary storage into main memory
[ ] a & b [ ] a & c [ ] c only [ ] a , b, & c

15. Which of the following are typical file attributes?
a. Name b. Size c. Location
[ ] a & b [ ] a & c [ ] b & c [ ] a , b, & c

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16. In a two-level directory structure, there are two levels of directories. The first level directory contains subdirectories, and the second level directories contain files. What is the advantage of this type of directory structure?
    a) It allows for better organization of files
    b) It makes it easier to find files
    c) It is more efficient in terms of storage space than a single level directory structure
    [ ] a & b [ ] a & c [ ] b & c [ ] a , b, & c

17. Which of the following file access methods allows for reading and writing of arbitrary data at any position in the file?
    [ ] Sequential access [ ] Random access
    [ ] Direct access [ ] Indexed access

18. Consider a disk queue with requests for I/O to blocks on cylinders. 98, 183, 37, 122, 14, 124, 65, 67. Considering SSTF (shortest seek time first) scheduling, the total number of head movements is, if the disk head is initially at 53 is?
    [ ] 224 [ ] 236 [ ] 245 [ ] 240

19. What is the purpose of an I/O subsystem in an operating system?
    [ ] To manage the physical storage devices
    [ ] To provide a hierarchical file organization
    [ ] To handle input and output operations between the CPU and I/O devices
    [ ] To schedule processes in a round-robin fashion

20. When device A has a cable that plugs into device B, and device B has a cable that plugs into device C and device C plugs into a port on the computer, this arrangement is called a……..
    [ ] port [ ] daisy chain [ ] bus [ ] cable

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SECTION "B"
[6Q. × 4= 24 marks]

Attempt *ANY SIX* questions.

1. Some early computers protected the operating system by placing it in a memory partition that could not be modified by either the user job or the operating system itself. Describe two difficulties that you think could arise with such a scheme. Differentiate between timesharing and multiprocessing operating system? [2+2]

2. What is Race Condition? Describe how semaphore can be used to solve the critical section problem? [1+3]

3. Describe Segmentation with suitable block diagram and write its advantage over Contiguous memory allocation technique? Consider a logical address space of 256 pages with a 4-KB page size, mapped onto a physical memory of 64 frames.
   a. How many bits are required in the logical address? [2]
   b. How many bits are required in the physical address? [2]

4. What is page fault? Explain how page fault is handled in demand paging with suitable block diagram? [1+3]

5. List and write the function of different types of file access? Describe a acyclic graph structure with suitable block diagram [1+3]

6. A disk drive has 50 cylinders, numbered 0 to 49. The drive is currently serving a request at cylinder 15, and the queue of pending requests, in FIFO order is 4, 40, 11, 35, 7, 14. What is the total distance that the disk arm moves for the following algorithms: [4]
   a) FCFS b) SSTF c) LOOK d) C-SCAN

7. Write Short notes on: [2+2]
   a. Application of I/O Interface
   b. Interrupt driven I/o Cycle

SECTION "C"
[2Q. × 8 =16 marks]

Attempt *ALL* questions.

8. What are the differences between fixed partitioning and variable partitioning system of memory for multiprogramming? Given reference to the following pages by a program: 0, 9, 0, 1, 8, 1, 8, 7, 8, 7, 1, 2, 8, 2, 7, 8, 2, 2 , 8, 3
   How many page faults will occur if the program has 4 frames for Optimal, Least recently used Page Replacement algorithm [3+5]

9. Which type of process is generally favored by a multilevel feedback queuing scheduler a processor-bound process or an I/O-bound process? Briefly explain why. Consider the following set of processes, with the length of the CPU burst time given in milliseconds. [2+3+2+1]

Process	Burst Time	Priority	Arrival Time
P1	50 ms	4	0 ms
P2	20 ms	1	20 ms
P3	100 ms	3	40 ms
P4	40 ms	2	60 ms

a. Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, a non-preemptive priority (a smaller priority number implies higher priority) and RR (quantum = 30 ms) scheduling.
b. What is turnaround time of each process for each of the scheduling algorithm?
c. Which of the above scheduling algorithm is better?

10. Explain Linked list and Indexed allocation file access mechanism with suitable block diagram? Why is deadlock state more critical than starvation in a multiprogramming environment? Consider a system with four processes P1 to P4 and four resource types A, B, C and D. Resource type A has 6 instances, resources type B has 4 instances, resources type C has 8 instances and resource type D has 5 instances. Suppose that at time T0 the following snapshot of the system has been take

Allocation

	A	B	C	D
P1	1	1	1	1
P2	2	0	1	0
P3	2	0	2	2
P4	0	2	1	1

Max

	A	B	C	D
P1	2	1	2	1
P2	2	4	3	2
P3	5	4	2	2
P4	0	3	4	1

Available

A	B	C	D
1	1	3	1

At time T1 process P2 made a request for (0, 1, 1, 0) resources. After granting this request, determine whether the system will still be in safe state using algorithm? Justify your answer. [4+4]