KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Marks Scored:

Level : B.Sc.
Year : III
Course : COMP 307
Semester : II

Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No. :
Date :

SECTION "A"
[20Q. × 0.5 = 10 marks]

Mark [×] the most appropriate box.

1. The main function of the command interpreter is to _____.
   a. provide the interface between the API and application program
   b. handle the files in the operating system
   c. get and execute the next user-specified command
   [ ] a & b [ ] a & c [ ] b & c [ ] a, b & c

2. To access the services of the operating system, the interface is provided by the _____.
   [ ] API [ ] Library
   [ ] Assembly Instructions [ ] System Call

3. Which of the following scheduler selects the process from the mass storage device and loads them into the memory for execution?
   a. Long term Scheduler b. Job Scheduler c. Short-term Scheduler
   [ ] a & b [ ] a & c [ ] b & c [ ] a, b & c

4. In a timeshare operating system, when the time slot assigned to a process is completed, the process switches from the current state to?
   [ ] Waiting State [ ] Terminated state
   [ ] Ready State [ ] Blocked State

5. A situation where several processes access and manipulate the same data concurrently and the outcome of the execution depends on the particular order in which access takes place is called _____.
   [ ] data consistency [ ] race condition [ ] aging [ ] starvation

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. Which of the following condition is required for a deadlock to be possible?
   a. mutual exclusion
   b. a process may hold allocated resources while awaiting assignment of other resources
   c. resource can be forcibly removed from a process holding it
   [ ] a & b [ ] a & c [ ] b & c [ ] a, b &c

8. Deadlock prevention is a set of methods _____.
[ ] to ensure that at least one of the necessary conditions cannot hold
[ ] to ensure that all of the necessary conditions do not hold
[ ] to decide if the requested resources for a process have to be given or not
[ ] to recover from a deadlock

9. If the size of logical address space is 2^m, and a page size is 2^n addressing units, then the high order _____ bits of a logical address designate the page number, and the _____ low order bits designate the page offset.
[ ] m, n [ ] m – n, m [ ] n, m [ ] m – n, n

10. When will External fragmentation occur?
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 (3, 500)?
[ ] Addressing error [ ] 719
[ ] 590 [ ] 1827

12. A process refers to 5 pages, A, B, C, D, E in the order : A, B, C, D, A, B, E, A, B, C, D, E. If the page replacement algorithm is FIFO, the number of page transfers with an empty internal store of 3 frames is :
[ ] 8 [ ] 10 [ ] 9 [ ] 7

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. A process is thrashing if _____.
[ ] it spends a lot of time executing, rather than paging
[ ] page fault occurs
[ ] it spends a lot of time paging, than executing
[ ] it has no memory allocated to it

15. To create a file _____.
a. allocate the space in file system
b. make an entry for new file in directory File owner
c. open the file
[ ] a & b [ ] a & c [ ] b & c [ ] a, b, & c

16. Which directory structure does allow its directory to share its subdirectories and files?
[ ] Single level directory [ ] Two level directory
[ ] Tree Structure directory [ ] Acyclic graph directory

17. For a direct access file _____.
[ ] there are restrictions on the order of reading and writing
[ ] there are no restrictions on the order of reading and writing
[ ] access is restricted permission wise
[ ] access is not restricted permission wise

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. The _____ program initializes all aspects of the system, from CPU registers to device controllers and the contents of main memory, and then starts the operating system.
[ ] main [ ] bootloader [ ] bootstrap [ ] ROM

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? What are the three main purposes of an operating system? [1.5+2.5]

2. Race conditions are possible in many computer systems. Consider a banking system that maintains an account balance with two functions: **deposit(amount)** and **withdraw(amount).**These two functions are passed the amount that is to be deposited or withdrawn from the bank account balance. Assume that a husband and wife share a bank account. Concurrently, the husband calls the **withdraw( )** function and the wife calls **deposit()**. Describe how a race condition is possible and what might be done to prevent the race condition from occurring? Explain Peterson's solution for solving the critical section problem with a pseudo code? [2+2]

3. Describe Segmentation with suitable block diagram and write its advantage over Contiguous allocation technique? Consider a logical address space of 64 pages of 1,024 words each, mapped onto a physical memory of 32 frames. [2+2]
   a. How many bits are there in the logical address?
   b. How many bits are there in the physical address?

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

5. Discuss the overall strategy of Indexed allocation method. [4]

6. Disk 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? [4]
   a. FCFS
   b. SCAN
   c. C-LOOK

7. Write Short notes on: [2+2]
   a. Memory mapped I/O
   b. DMA

SECTION "C"

[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. 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. [3+3+1+1]

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

The processes are assumed to arrive in the order P1, P2, P3, P4, P5 all at time 0.

a. Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, a non-preemptive priority and RR (quantum = 1) scheduling. 3
b. What is turnaround time of each process for each of the scheduling algorithm?
c. Which of the above scheduling algorithm is better?

9. a. Explain segmentation with paging technique? How segmentation supports the relocation? [3+1]

b. What do you mean by Belady's anomaly? Which page replacement algorithm never suffers from Belady's anomaly? A computer has four page frames. The time of loading, time of last access, and the R (Referenced) and M (Modified) bits for each page are as shown below (the times are in clock ticks): [1+1+2]

Page	Loaded	Last Reference	R	M
0	126	280	1	0
1	230	265	0	1
2	140	270	0	0
3	110	285	1	1

i. Which page will FIFO replace?
ii. Which page will LRU replace?
iii. Which page will second chance replace?

10. Why is deadlock state more critical than starvation in a multiprogramming environment? Describe a resource allocation graph, i) with a deadlock ii) with a cycle but no dead lock? 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 taken.

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. [1.5+1.5+5]