[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6505 **HC**

Unique Paper Code : 32341302

Name of the Paper : Operating Systems

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

Semester : III

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Q. 1 is compulsory.
3. Attempt any 4 questions out of the questions from Q. 2 to Q. 6.
4. Parts of a question must be answered together.

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

(i) the mode in which operating system executes

(ii) A software generated interrupt

(iii) the path name that begins at the root and follows a path down to the specified file

P.T.O.

(iv) excessive number of page faults that results in degradation of the system performance

(v) this type of file allocation allows only sequential access of the file

(vi) a way of interprocess communication

(b) Consider the following code segment :

```
int a = 10, p = fork();
if (p == 0)
    a++;
else {
    wait(NULL);
    a--;
}
cout << a << endl;
```

(i) What will be the output of the code segment? (1)

(ii) What are the possible outputs if wait() statement is removed and why? (2)

(c) What is Processor Affinity? (1)

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

(i) Free space management using grouping and counting

(ii) Data parallelism and Task parallelism in threads

(iii) Long term scheduler and Short term scheduler

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

Case 1: renaming a file

Case 2: copying a file and deleting the original file

(f) Consider the following segment table :

Segment	Base	Length
0	200	600
1	1200	20
2	40	150

What are the physical addresses for the following logical addresses?

(i) 1,30 (ii) 2,100 (2)

(g) If the total number of frames in main memory is 60 and there are 4 processes in the system with the demand as

P.T.O.

30, 10, 100 and 60 frames, respectively. What will be the number of frames allocated using the following allocation strategies?

(i) equal allocation (1)

(ii) proportional allocation (2)

(h) What is busy waiting in semaphores? How can it be removed? (3)

(i) What is the main advantage of the layered approach to system design? What are the disadvantages of using the layered approach? (1+2)

(j) Why command interpreter is usually placed separate from the kernel? (2)

(k) What are real time embedded systems? (2)

(l) How can timer be used to protect CPU? (2)

(m) Compare indexed and linked allocation schemes. (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	5	2
P_2	2	3	1 (Highest)
P_3	5	6	3
P_4	6	2	4

(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 128KB 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	20
P1	Allocation	15
P2	Allocation	10
P3	Allocation	25
P0	Deallocation	
P2	Deallocation	
P4	Allocation	8
P5	Allocation	10

P.T.O.

3. (a) A system has 3 processes P1, P2 and P3, and 3 resources R1, R2 and R3. There are 2 instances each of R1 and R2, and one instance of R3. Given the edge set E = {R1 → P1, R2 → P2, P1 → R3, R1 → P2, P3 → R1, R2 → P3, R3 → P3}.

(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) What is file-open count? When does its value become zero? (2)

(c) Explain any three challenges in programming for multicore systems. (3)

4. (a) Consider a file system on a disk that has both logical and physical block sizes of 1-KB. If we are currently at logical block 15 and want to access logical block 6, how many physical blocks must be read from the disk for the following access methods and why?

(i) sequential

(ii) direct (4)

(b) Consider the following page reference string

0 3 1 4 7 6 2 7 6 2 7 1 4 7 3 2 1 2 1

How many page faults would occur with FCFS and optimal page replacement algorithms assuming three frames? All frames are initially empty. (6)

5. (a) Consider a logical address space of 128 pages with 2-KB frame size mapped onto a physical memory of 512 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) What is the maximum number of entries in the conventional page table and in the inverted page table? (2)

(b) What is a Process Control Block? Explain any of its four components. (4)

6. (a) Suppose a disk drive has 200 cylinders numbered from 0 to 199. The request for 62 is being serviced and is

P.T.O.

moving towards track 99 and the disk request queue contains read/write requests for the sectors on tracks 184, 55, 103, 96 and 197 respectively. What is the total number of head movements needed to satisfy the requests in the queue using :

(i) FCFS

(ii) LOOK (3+2)

(b) What is the critical section problem? What are the three requirements for a solution to the critical section problem? (2+3)

TUTORIALSDUNIYA.COM

Get FREE Compiled Books, Notes, Programs, Question Papers with Solution etc of the following subjects at https://www.tutorialsduniya.com

- C and C++
- Java
- Data Structures
- Computer Networks
- Android Programming
- PHP Programming
- JavaScript
- Java Server Pages
- Python
- Microprocessor
- Artificial Intelligence
- Machine Learning
- Computer System Architecture
- Discrete Structures
- Operating Systems
- Algorithms
- DataBase Management Systems
- Software Engineering
- Theory of Computation
- Operational Research
- System Programming
- Data Mining
- Computer Graphics
- Data Science

- DU Programs: https://www.tutorialsduniya.com/programs
- TutorialsDuniya App: http://bit.ly/TutorialsDuniyaApp
- C++ Tutorial: https://www.tutorialsduniya.com/cplusplus
- Java Tutorial: https://www.tutorialsduniya.com/java
- JavaScript Tutorial: https://www.tutorialsduniya.com/javascript
- Python Tutorial: https://www.tutorialsduniya.com/python
- Kotlin Tutorial: https://www.tutorialsduniya.com/kotlin
- JSP Tutorial: https://www.tutorialsduniya.com/jsp

08/12/18 Library

This question paper contains 8 printed pages]

Roll No. | | | | | | | | | | | |

S. No. of Question Paper : 49

Unique Paper Code : 32341302 I

Name of the Paper : Operating Systems

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

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 of 35 marks is compulsory.

Attempt any *four* questions from Q. Nos. 2 to 7.

1. (*a*) Fill in the following blanks : 5

(*i*) The two modes of execution of an operating system are ..... and .....

(*ii*) ..... provide(s) an interface to the services provided by an operating system.

(*iii*) A necessary condition for a deadlock which states that a resource held by a process cannot be taken away forcibly .....

P.T.O.

(iv) ..... scheduling is approximated by predicting the next CPU burst with an exponential average of the measured lengths of previous CPU bursts.

(v) The mapping of a logical address to a physical address is done in hardware by the .....

(b) What is a file allocation table ? 2

(c) Differentiate between : 4

(i) binary semaphore and mutex

(ii) counting semaphore and binary semaphore ?

(d) What is a bootstrap program ? Where is it stored ? 2

(e) Given five memory partitions of sizes 750 KB, 575 KB, 225 KB, 510 KB, 300 KB (in order). How would the best-fit algorithm place processes of sizes 450 KB, 540 KB, 200 KB, and 560 KB (in order) ? 2

(f) What are the advantages of using loadable kernel modules ? 2

(g) Which of the following scheduling algorithms could result in starvation ? Justify your answer : 2

(i) First-come, first-served

(ii) Shortest job first

(iii) Round robin

(iv) Priority.

(*h*) Given that the actual pids of the parent and child in the following program fragment are 1500 and 1700 respectively, identify the pids at lines (*a*), (*b*), (*c*) and (*d*) (assume that fork is executed successfully) : 4

```
{
pid_t pid1, pid2;
pid1 = fork();
if (pid1 == 0){
    pid2 = getpid();
    printf("pid1 = %d", pid1);      /* (a) */
    printf("pid2 = %d", pid2);      /* (b) */
    }
else{
    pid2 = getpid();
    printf("pid1 = %d", pid1);      /* (c) */
    printf("pid2 = %d", pid2);      /* (d) */
    wait (NULL);
    }
}
```

P.T.O.

(*i*) What is the use of `pthread_join( )` function ? 2

(*j*) Consider a logical address space of 128 pages with 2 KB page size, mapped onto a physical memory of 64 frames : 3

(*i*) How many bits are required in the logical address ?

(*ii*) How many bits are required in the physical address ?

(*k*) Assume a program has just referenced an address in virtual memory. Which of the following scenarios can occur and which cannot. Justify your answer : 3

(*i*) TLB hit and page fault

(*ii*) TLB miss with no page fault.

(*l*) What is a mount point ? 2

(*m*) Describe the in-memory structures for file system management. 2

2. (*a*) Compare client-server computing and peer to peer computing.

(*b*) Consider the following code segment : 4

```
pid_t pid;
pid = fork();
if (pid == 0){
    fork();
    thread_create( . . .);
}
fork();
```

(*i*) How many unique processes are created ?

(*ii*) How many unique threads are created ?

(*c*) What are the three mechanisms for implementing index block for large files in the indexed allocation scheme ? 3

3. (*a*) Differentiate between internal and external fragmentation. Which of the following memory organization schemes suffer from external fragmentation : contiguous memory allocation, paging. Give arguments to support your answer. 2+3

(*b*) Describe the Readers Writers synchronization problem. Suggest the process structures to solve this problem. 5

P.T.O.

4. (*a*) Consider the following set of processes, with the length of the CPU burst given in milliseconds. Given that the order of arrival of the processes is P1, P2, P3 and P4 (all at time zero), determine the average waiting time of each process for the following scheduling algorithms : 6

(*i*) SJF (non-preemptive)

(*ii*) RR (quantum = 2)

Process	Burst Time
P1	4
P2	3
P3	9
P4	6

(*b*) How many memory accesses are required in the case of a TLB hit and TLB miss ? Consider a paging system with the page table stored in TLBs. Given that 90 percent of the page references are found in the TLBs, determine the effective memory reference time if a memory reference takes 150 nanoseconds. (Assume that finding a page-table entry in the TLBs takes zero time, if the entry is there.) 4

5. (*a*) Two processes P1 and P2 are simultaneously accessing the following code. Demonstrate the impact of race condition in this scenario : 3

```
x = 1;
Func( )
{
    If (x ==0)
        Return;
    x--;
}
```

(*b*) What do you understand by *locality of reference* ? Explain the working set model to avoid thrashing. 3

(*c*) List the different types of directory structures giving one advantage of each. 4

6. (*a*) Explain the following in the context of demand paging : 4

(*i*) Belady's anomaly

(*ii*) copy-on-write.

(*b*) Assuming a 2 KB page size, what are the page numbers and offsets for the following address references provided as decimal numbers (assume that the page numbers begin with zero) : 2

(*i*) 7825

(*ii*) 17239.

P.T.O.

(c) For a 32 bit logical address, calculate the number of bits in the page number and page offset fields given that the page size is 2 KB. 2

(d) Would it be appropriate to have a web server run as a single-threaded process ? Why or why not ? 2

7. (a) Write two methods that implement the `wait( )` and `signal( )` operations for a semaphore *s*. 4

(b) Consider the following page reference string : 4

9, 5, 3, 6, 5, 8, 2, 1, 9, 9, 0, 7.

Assuming demand paging with four frames, how many page faults would occur for the following replacement algorithms ?

- FIFO replacement
- Optimal replacement.

(c) Justify that the mutual exclusion condition is necessary for a deadlock to occur. 2

TUTORIALSDUNIYA.COM

Get FREE Compiled Books, Notes, Programs, Question Papers with Solution etc of the following subjects at https://www.tutorialsduniya.com

- C and C++
- Java
- Data Structures
- Computer Networks
- Android Programming
- PHP Programming
- JavaScript
- Java Server Pages
- Python
- Microprocessor
- Artificial Intelligence
- Machine Learning
- Computer System Architecture
- Discrete Structures
- Operating Systems
- Algorithms
- DataBase Management Systems
- Software Engineering
- Theory of Computation
- Operational Research
- System Programming
- Data Mining
- Computer Graphics
- Data Science

- DU Programs: https://www.tutorialsduniya.com/programs
- TutorialsDuniya App: http://bit.ly/TutorialsDuniyaApp
- C++ Tutorial: https://www.tutorialsduniya.com/cplusplus
- Java Tutorial: https://www.tutorialsduniya.com/java
- JavaScript Tutorial: https://www.tutorialsduniya.com/javascript
- Python Tutorial: https://www.tutorialsduniya.com/python
- Kotlin Tutorial: https://www.tutorialsduniya.com/kotlin
- JSP Tutorial: https://www.tutorialsduniya.com/jsp

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1402 **C**

Unique Paper Code : 32341302

Name of the Paper : Operating Systems

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

Semester : III

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory. Attempt any **4** questions from **Section B.**
3. Parts of a question must be answered together.

SECTION A

1. (i) Which algorithm is the preemptive version of First in First out CPU scheduling algorithm? (1)

(ii) What is the name given to the section of code or set of operations in which process is working on its shared variables? (1)

P.T.O.

(iii) What is 'Dirty bit' in Demand paging? Where this bit is stored by the Operating System? (2)

(iv) Why command interpreter is usually placed separate from the kernel? (2)

(v) Write any two problems that may occur in multiprogramming environment? (2)

(vi) How degree of multiprogramming affects CPU performance? (2)

(vii) Explain the type of fragmentation that occurs in segmentation? (2)

(viii) Using semaphores, how can we achieve the condition of having statement 'a' of process P1 to be executed only after 'b' condition of process P2. (2)

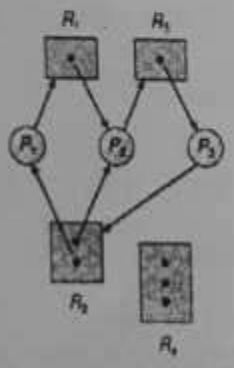
(ix) List any two privileged instructions? (2)

(x) What is the significance of two separate modes of operation in operating systems? (2)

(xi) Which are the two conditions under which a parent may terminate the execution of one of its children? (2)

(xii) Write the bit vector representation for free space list for a disk (10 blocks) where blocks 1, 2 and 5 are free and rest of the blocks are allocated. Give one advantage of this representation. (2)

(xiii) Determine whether the deadlock occur in the given resource 3 allocation graph of three processes as P_1, P_2 and P_3 and four resources as R_1 (one instance), R_2 (two instance), R_3 (one instance) and R_4 (3 instances)? Justify your answer. (3)



(xiv) How many child processes are created in the following fragment of code assuming essential header files are included? Explain the output with justification.

```
int main()
  {
  for (int i=0;i<4;i++)
     fork();
  return 0;
  }
```

(1+2)

P.T.O.

(xv) Consider a system of five resources (assuming every resource is having one instance only) and four processes where every process requires two resources to complete its work. Is there any chance of deadlock in this scenario? Justify your answer after applying all the necessary conditions of deadlock. (3)

(xvi) Consider a logical address space of 512 pages with 4-KB page size, mapped onto a physical memory of 128 frames.

(a) How many bits are required in the logical address?

(b) How many bits are required in the physical address? (2+2)

SECTION B

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

Processes	Burst Time	Arrival Time
P1	9	0
P2	5	2
P3	6	3
P4	4	5
P5	8	6

(a) Draw the Gantt chart illustrating the execution of these processes using Shortest Remaining Time First (SRTF) algorithm? (3)

(b) Based on the above obtained Gantt chart, calculate the average turnaround time and average waiting time for the given processes. (3)

(ii) Illustrate with an example if the wait and signal operations are not executed atomically, then mutual exclusion is violated? (4)

3. (i) Differentiate the following :

(a) Long term schedular and Short term schedular

(b) Asymmetric multiprocessing and Symmetric multiprocessing

(c) Monolithic and Microkernel approach to Operating system design (3×2)

(ii) Consider the following page reference string :

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

Assuming demand paging with three frames, how many page faults would occur for the following page replacement algorithms :

(a) Optimal replacement

(b) FIFO replacement (4)

4. (i) Consider the following segment table :

Segment	Base	Length
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?

(a) 0, 230

(b) 1, 10

(c) 2, 300

(d) 3, 400

(e) 4, 200

(5)

(ii) For a paged system, Translation Lookaside Buffer (TLB) hit ratio is 80%. Let RAM access time, t is 20 ns and TLB buffer access time, T is 100 ns. Find out

(a) Effective memory access with TLB

(b) Effective memory access without TLB

(3)

(iii) Justify the requirement of logical and physical addresses in an operating system? (2)

5. (i) What is race condition in process synchronization? Explain it with an example.

(4)

(ii) Consider a disk drive of 5000 cylinders, numbered from 1 to 4999. (6)

The drive is currently serving a request at cylinder 143, and the previous request was at

cylinder 125. The queue of pending request in FIFO order is 86, 1470, 913, 1774, 948, 1509

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

(a) Shortest seek time first (SSTF)

(b) Circular SCAN (C-SCAN)

Give all the intermediate calculations.

6. (i) Compare and contrast the following : (4)

(a) Peer to Peer Computing and Client-Server Computing

(b) Data parallelism and Task parallelism

(ii) What is the role of virtualization in cloud computing? (4)

(iii) Compute the context switch time for a user process of 100 MB using the swapping memory management scheme, if the backing store has a transfer rate of 50MB per second. (2)