

Roll Number: _____

Thapar University, Patiala

Department of Computer Science & Engineering

END SEMESTER EXAMINATION

B. E. (Second Year): Semester-I (2017/18)
(COE/ECE)

Course Code: UCS303

December 04, 2017

Course Name: Operating Systems

Time: 3 Hours, M. Marks: 100

Monday, 9.00 am - 12.00 noon

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Note: Attempt questions in sequential order please; Question paper is having three pages; Assume missing data, if any, suitably.

- Q.1 Explain the following file allocation methods with suitable diagram(s): (5)
(a) Linked allocation
(b) Indexed allocation
- Q.2 Differentiate between peer-to-peer and client-server computing environments. (5)
- Q.3 (a) Write and explain the pseudo-code/algorithm/program of **Peterson's Solution** used for accessing the critical section by two co-operating processes.
(b) Define concurrency and race condition. (5)
- Q.4 Consider a computer system with 2^{64} bits virtual address space and page size of 1 Kbyte. The physical memory is of 64 Kbytes and the size of page table entry is 2 bytes. Calculate size of **conventional page table** and **inverted page table**. Assume addressing at a byte level. (5)
- Q.5 Consider the information regarding multi-disk drive given below: (5)
Number of platters/disk = 6
Number of surfaces/platter = 2
Number of cylinders = 32
Number of sectors/ track = 64
Sector capacity = 512 bytes
Cylinders capacity = 393216 bytes
Number of disks=2
(a) Find the capacity of multi-disk;
(b) If record size is twice the size of the sector, then find the number of records that can be stored on disk?
- Q.6 With a suitable diagram, explain **RAID** level 0, 3, 5, (0+1), (1+0) (10)
- Q.7 You have a demand-paged system, where integers are stored in 4 bytes, page size is of 256 bytes, LRU page replacement is used, and each process is allocated 3 frames (initially all empty). A process executes the following code:
- ```
int [] [] Arr = new int [200] [200]; //Memory allocation for 2-D Array
int i = 0;
int j = 0;
while (i++ < 200) {
 j = 0;
```

```

 while (j++ < 200)
 Arr[i][j] = 0;
 }

```

The code occupies page 0 and, since a location from page 0 is referenced by each instruction of given code snippet, page 0 is always swapped-in. Variables i and j are stored in fast registers. **How many page faults are generated** for initialization of array named **Arr**, assuming all elements of the array are stored in contiguous memory locations in row-major order?

Q.8 With a suitable depiction, explain the concept of **Hashed Page Table**. (05)

Q.9 Given reference to the following pages by a program, (10)

0, 9, 0, 1, 8, 1, 8, 7, 8, 7, 1, 2, 8, 2, 7, 8, 2, 3, 8, 3

With the help of a suitable depiction, comment on the count of page faults that will occur if the program has three page frames (initially empty) available to it and uses **Optimal page replacement algorithm**.

Q.10 On a disk with 1000 cylinders, numbers 0 to 999, **compute the number of tracks** the disk arm must move to satisfy all the requests in the disk queue. The disk queue contains requests for the following tracks: 123, 874, 692, 475, 105, 376. Assume the last request serviced was at track 345 and the head is moving towards track 0.

Perform the computation for the following disk scheduling algorithms:

(a) SCAN      (b) LOOK      (c) C-SCAN      (d) C-LOOK

Q.11 Consider a disk drive system with 8 platters (with one surface only), (10) where each surface is having an outer diameter of 16 cm and an inner diameter of 6 cm and the track width is 0.2 mm. There are 32 sectors in each track. If the disk addresses for reading a byte of a sector on track of the platter is 27 bits:

(a) What is the **sector size** in bytes?

(b) If the disk rotates at 3600 rpm, what is the effective **data transfer rate** (for a track) in byte/sec?

Q.12 Consider a system with the following current resource-allocation state: (10)  
There are five processes: P<sub>0</sub>, P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub>, P<sub>4</sub> and three resource types: A, B and C. For each process, the current allocation and the maximum required allocation are given by the Allocation and MAX matrices respectively. The current available resources are given by the Available vector.

|                | Allocation |   |   | MAX |   |   | Available |   |   |
|----------------|------------|---|---|-----|---|---|-----------|---|---|
|                | A          | B | C | A   | B | C | A         | B | C |
| P <sub>0</sub> | 1          | 1 | 2 | 4   | 3 | 3 | 2         | 1 | 0 |
| P <sub>1</sub> | 2          | 1 | 2 | 3   | 2 | 2 |           |   |   |
| P <sub>2</sub> | 4          | 0 | 1 | 9   | 0 | 2 |           |   |   |
| P <sub>3</sub> | 0          | 2 | 0 | 7   | 5 | 3 |           |   |   |
| P <sub>4</sub> | 1          | 1 | 2 | 11  | 2 | 3 |           |   |   |

(a) Determine the total amount of resources of each type.

(b) What is the "Need matrix"?

- (c) Determine if this state is "Safe" using the "Safety Algorithm".  
(d) Starting with the allocation resource state given above, suppose the current request for each process is given by the Request matrix below. Furthermore, assume that these requests are granted.

*Request Matrix:*

|                | A | B | C |
|----------------|---|---|---|
| P <sub>0</sub> | 3 | 3 | 1 |
| P <sub>1</sub> | 1 | 1 | 0 |
| P <sub>2</sub> | 6 | 0 | 1 |
| P <sub>3</sub> | 7 | 2 | 3 |
| P <sub>4</sub> | 0 | 1 | 1 |

Will the system be in a deadlocked state? Determine this using the *Deadlock detection algorithm*.

- Q.13 On a system with n CPUs, what is the minimum number of processes that can be in the ready, run, and blocked states? Explain with a suitable **process state diagram**. (5)
- Q.14 A system has three processes and four identical resources. Each process needs a maximum of three resources to complete. **Is deadlock possible?** Explain your answer. (5)