



# UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program : Fifth Semester – Fall 2021

Paper: Operating Systems (CMP)

Course Code: IT-306

Roll No. ....

Time: 3 Hrs.

Marks: 60

**Q.1. Give short answers of the following: (6x5=30)**

- A) What is the difference between User Mode and System Mode?
- B) Explain dispatch latency and its causes and effects.
- C) What is starvation? Explain with the help of two examples.
- D) What is PCB? What are different types of information stored in PCB about a process? At the time of context-switch what role PCB plays?
- E) Write one solution for classical Producer-Consumer problem with only three shared variables (in, out and buffer).
- F) Write code for wait() and signal() operations of counting semaphore.

**Q.2. Solve the following: (3x10=30)**

i. **Recall Reader-Writer problem with readers priority and check the following code. Re- by adding missing lines.**

```
do {
    readcount++;
    if (readcount == 1)    wait(wrt);

    ...
    // reading is performed
    ...
    readcount--;
    if (readcount == 0)
        signal(wrt);
} while(1);
```

ii. **Consider a logical address space of 64 pages of 1,024 words each, mapped onto a physical memory of 32 frames.**

- a. How many bits are there in the logical address?
- b. How many bits are there in the physical address?
- c. How many bits needed for offset?

iii. **A system has 4 processes and 5 resources. The current allocation and maximum needs are as follows:-**

	Allocated					Maximum				
A	1	0	2	1	1	1	1	2	1	3
B	2	0	1	1	0	2	2	2	1	0
C	1	1	0	1	1	2	1	3	1	1
D	1	1	1	1	0	1	1	2	2	0

If Available matrix consist of [0,0,2,1,1], Check whether system is in safe state or not. Also write safe sequence if system is in safe state.

Show detail working of your solution.



# UNIVERSITY OF THE PUNJAB

Fifth Semester 2018  
Examination: B.S. 4 Years Programme

Roll No. ....

PAPER: Operating Systems (CMP)  
Course Code: IT-306

TIME ALLOWED: 2 hrs. & 30 mins.  
MAX. MARKS: 50

*Attempt this Paper on Separate Answer Sheet provided.*

## SUBJECTIVE TYPE

### Part-II

A very short answer is required for each of the following questions. [10 x 2 = 20]

- Which system call is used to create a process in UNIX?
- How hardware devices use the functionality of an operating system?
- What is meant by CPU-protection?
- What is meant by dual-mode operation?
- What is the function of ready queue?
- What is the difference between Long Term Scheduler and Short Term Scheduler?
- In which memory management technique process can be divided into equal parts?
- In which memory management technique, system suffers from External Fragmentation?
- What is meant by critical section?
- What is meant by race condition?

### Part -III

Answer the following questions briefly. [6 x 5 = 30]

- Explain five states process model.
- What are the different multithreading models?
- Name the different techniques used for process synchronization.
- What are the necessary conditions for the deadlock to exist?
- Determine the system state for the following resource allocation state by using Banker's algorithm.

	<u>Allocation</u>				<u>Max</u>				<u>Available</u>			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	2	1	0	1	5	1	6	3	3	1	8	1
P1	2	5	1	1	4	8	3	2				
P2	0	1	0	1	0	2	0	1				
P3	0	2	2	1	0	2	2	5				
P4	3	1	1	0	9	1	8	0				
P5	0	1	2	2	0	1	7	7				

- Consider a computer system with a 24-bit logical address space and with 2 KB page size. Suppose that the maximum physical memory size is 64 MB, and the system is byte-addressable. Let paging be implemented for the system. Give answer to following five questions:
  - How many bits for p and d are there in the logical address?
  - How many pages are there in the process?
  - How many frames are there in the memory?
  - What is the size of the page table if one entry in the page table is of 4 bytes?
  - How many levels of paging will be required for the above scenario?



**UNIVERSITY OF THE PUNJAB**

Roll No. ....

**Fifth Semester 2018**  
**Examination: B.S. 4 Years Programme**

**PAPER: Operating Systems (CMP)**  
**Course Code: IT-306**

**TIME ALLOWED: 30 mins.**  
**MAX. MARKS: 10**

*Attempt this Paper on this Question Sheet only.*

**OBJECTIVE TYPE**

Part-I

Select the best option for the following multiple choice questions.

[10]

1. What is operating system?
  - a) collection of programs that manages hardware resources
  - b) system service provider to the application programs
  - c) link to interface the hardware and application programs
  - d) all of the mentioned
  
2. To access the services of operating system, the interface is provided by the
  - a) system calls
  - b) API
  - c) library
  - d) assembly instructions
  
3. Which one of the following is not true?
  - a) kernel is the program that constitutes the central core of the operating system
  - b) kernel is the first part of operating system to load into memory during booting
  - c) kernel is made of various modules which cannot be loaded in running operating system
  - d) kernel remains in the memory during the entire computer session
  
4. In operating system, each process has its own
  - a) address space and global variables
  - b) open files
  - c) pending alarms, signals and signal handlers
  - d) all of the mentioned
  
5. A process stack does not contain
  - a) function parameters
  - b) local variables
  - c) return addresses
  - d) PID of child process
  
6. Which module gives control of the CPU to the process selected by the short-term scheduler?
  - a) dispatcher
  - b) interrupt
  - c) scheduler
  - d) none of the mentioned

**P.T.O.**

7. Spinlocks are :

- a) CPU cycles wasting locks over critical sections of programs
- b) locks that avoid time wastage in context switches
- c) locks that work better on multiprocessor systems
- d) All of these

8. The number of resources requested by a process :

- a) must always be less than the total number of resources available in the system
- b) must always be equal to the total number of resources available in the system
- c) must not exceed the total number of resources available in the system
- d) must exceed the total number of resources available in the system

9. Deadlock prevention is a set of methods :

- a) to ensure that at least one of the necessary conditions cannot hold
- b) to ensure that all of the necessary conditions do not hold
- c) to decide if the requested resources for a process have to be given or not
- d) to recover from a deadlock

10. If one thread opens a file with read privileges then

- a) other threads in the another process can also read from that file
- b) other threads in the same process can also read from that file
- c) any other thread cannot read from that file
- d) all of the mentioned



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Roll No. ....

Fifth Semester 2017

Examination: B.S. 4 Years Programme

PAPER: Operating Systems (CMP)

TIME ALLOWED: 30 mins.

Course Code: IT-306

MAX. MARKS: 10

*Attempt this Paper on this Question Sheet only.*

## OBJECTIVE TYPE

**Question # 1** Multiple Choice Questions:

(10 marks)

1. \_\_\_\_\_ is not the component of OS.
  - a. Thread management
  - b. Networking
  - c. Protection system
  - d. Command-line interpreter
2. A PCB contains information associated with a specific process that is used by
  - a. OS to control the process.
  - b. CPU to execute a process
  - c. Process to terminate
  - d. None of above
3. \_\_\_\_\_ controls the degree of multiprogramming.
  - a. Long term scheduler
  - b. Short term scheduler
  - c. Medium term scheduler
  - d. Dispatcher
4. All Threads with in a process share the \_\_\_\_\_ address space
  - a. Same
  - b. Different
5. When several processes access the same data concurrently and the outcome of the execution depends on the particular order in which the access takes place, is called
  - a. Dynamic condition
  - b. Race condition
  - c. Essential condition
  - d. Critical condition
6. We can always prevent a deadlock from happening by providing for additional resources of the same kind
  - a. True
  - b. False
7. Which of the following are examples of non-preemptable resources:
  - a. CPU
  - b. Printer
  - c. Memory
  - d. CD writer
  - e. None of the above
8. How many level of paging will be implemented, if the system has 36bit logical address, page size is 4KB and Main memory is 4MB?
  - a. 2 level
  - b. 3 level
  - c. 4 level
  - d. 5 level
9. A solution to the problem of External fragmentation is :
  - a. Swapping
  - b. Compaction
  - c. Larger memory space
  - d. None of these
10. A solution to the problem of External fragmentation is :
  - a. Swapping
  - b. Compaction
  - c. Larger memory space
  - d. None of these



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Fifth Semester 2017

Examination: B.S. 4 Years Programme

Roll No. ....

PAPER: Operating Systems (CMP)  
Course Code: IT-306

TIME ALLOWED: 2 hrs. & 30 mins.  
MAX. MARKS: 50

Attempt this Paper on Separate Answer Sheet provided.

Question # 2 Short Questions **SUBJECTIVE TYPE** 5 x 4 = 20 marks

1. Differences between scheduler and dispatcher?
2. Mention four reasons for process creation?
3. States the Critical Section Problem. What requirements must a solution to the critical section problem satisfy?
4. What is the difference between Load Time Dynamic Linking VS Run Time Dynamic Linking?

Question # 3 Schedule the following processes using RR. The processes P1, P2 and P3 have arrived at time units 0, 1 and 2 respectively. The number inside the parenthesis indicates the time units for CPU and I/O bursts. Assume a time quantum of 4 time units. **10 marks**

- a. Create Gantt chart
- b. Calculate turnaround time

Process	CPU Burst	I/O Burst	CPU Burst	I/O Burst	CPU Burst
P1	3	6	2	4	5
P2	5	4	3		
P3	6	8	5	7	2

Question # 4 **10 marks**

- a. Differences between zombie and orphan processes?
- b. Give the output of the given code snippet.

```
int main ( int argc, char * argv [ ] )
{
    int pid, status;
    pid = fork();
    printf("start execution");
    if (pid > 0)
    {
        wait(&status);
        fork();
        printf("Between Creation");
        fork();
        printf("Inside Parent Process\n");
        printf("Bye\n");
    }
    else
    {
        printf("Inside Child Process\n");
        printf("Good Bye\n");
        fork();
        exit(0);
    }
    return 0;
}
```

Question # 5 **10 marks**

Consider three resource types in a system with following number of instances.

- A (9 instances)
- B (3 instances)
- C (6 instances)

System State is as shown below, find safe sequence (if any) using Bankers & Safety algorithm. In case if there is no safe sequence mention which process (es) are involved in dead lock.

PROCESS	MAX			ALLOCATION		
	A	B	C	A	B	C
P1	3	2	2	1	0	0
P2	6	1	3	6	1	2
P3	3	1	4	2	1	1
P4	4	2	2	0	0	2



**UNIVERSITY OF THE PUNJAB**  
Fifth Semester – 2019  
Examination: B.S. 4 Years Program

Roll No. in Fig. ....

Roll No. in Words. ....

PAPER: Operating Systems (CMP)  
Course Code: IT-306 Part-I (Compulsory)

MAX. TIME: 15 Min.  
MAX. MARKS: 10

Signature of Supdt. ....

**Attempt this Paper on this Question Sheet only.**  
**Please encircle the correct option. Division of marks is given in front of each question.**  
**This Paper will be collected back after expiry of time limit mentioned above.**

**Q.1. Encircle the right answer, cutting and overwriting is not allowed. (1x10=10)**

- I. In shortest job first algorithm CPU schedule process according to the,
  - a. Priority Wise
  - b. Distribute CPU resources equally among processes
  - c. CPU Burst
  - d. All of these
- II. The number of processes completed per unit time is known as
  - a) Output
  - b) Throughput
  - c) Efficiency
  - d) Capacity
- III. The degree of multiprogramming is:
  - a) the number of processes executed per unit time
  - b) the number of processes in the ready queue
  - c) the number of processes in the I/O queue
  - d) the number of processes in memory
- IV. If no cycle exists in the resource allocation graph then :
  - a) The system will not be in a safe state
  - b) The system will be in a safe state
  - c) All of the mentioned
  - d) none of the mentioned
- V. An IPC facility provides at least two operations :
  - a) write & delete message
  - b) delete & receive message
  - c) send & delete message
  - d) receive & send message
- VI. Virtual memory is
  - (a) Large secondary memory
  - (b) Large main memory
  - (c) Illusion of large main memory
  - (d) None of the above
- VII. Thrashing occurs when
  - (a) When a page fault occurs
  - (b) Processes on system frequently access pages not memory
  - (c) Processes on system are in running state
  - (d) Processes on system are in waiting state
- VIII. \_\_\_\_\_ is the concept in which a process is copied into main memory from the secondary memory according to the requirement.
  - a. Paging
  - b. Demand paging
  - c. Segmentation
  - d. Swapping
- IX. Swap space exists in:
  - a. primary memory
  - b. secondary memory
  - c. CPU
  - d. none of the mentioned
- X. When a program tries to access a page that is mapped in address space but not loaded in physical memory, then?
  - a. segmentation fault occurs
  - b. fatal error occurs
  - c. page fault occurs
  - d. no error occurs



# UNIVERSITY OF THE PUNJAB

Fifth Semester – 2019

Examination: B.S. 4 Years Program

Roll No. ....

PAPER: Operating Systems (CMP)  
Course Code: IT-306 Part – II

MAX. TIME: 2 Hrs. 45 Min.  
MAX. MARKS: 50

**ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED**

**Q.2. Questions with short answers.**

**(10 x 2 = 20)**

- I. What is Convay Effect?
- II. Explain different states of process?
- III. Difference between long-term scheduler and short-term scheduler?
- IV. Explain deadlock conditions?
- V. Define dispatcher latency?
- VI. Define demand paging?
- VII. What is the process address space?
- VIII. Difference between paging and segmentation?
- IX. Define turn-around time?
- X. Define two operations of semaphore?

**Q.3. Questions with long answers.**

**(3 x 10 = 30)**

(a) Solve the following question using banker's algorithm?

	ALLOCATION				MAX				AVAILABLE			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	0	1	0	0	0	5	1	3	1	3	2	2
P1	1	0	0	0	1	2	5	2				
P2	1	0	5	2	2	0	5	2				
P3	0	1	3	1	0	2	5	2				
P4	0	0	1	2	0	3	5	3				

- i. What is the content of the need matrix? (5)
  - ii. Is the system in a safe state? (5)
- (b) Find the average waiting time using Shortest Remaining time method? (10)

Process	Arrival Time	Burst Time
P1	0.0	7
P2	2.0	4
P3	4.0	1
P4	5.0	4

(c) Given memory partitions of 100K, 600K, 200K, 300K, and 500K (in order), how would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 409K, 236K, 125K, and 514K (in order)?

1. Also define First-fit, Best-fit, and Worst-fit algorithms. (6)
2. Which algorithm makes the most efficient use of memory? (4)



- ✓(b) What is the waiting time of each process? [4]
- ✓(c) What is the average waiting time of the schedule? [2]
- ✓(d) What will be the average waiting time of the schedule if process arrival sequence is P1, P3, P4, P2, P5? [6].
- ✓(e) Consider a logical address space of 64 pages. Size of each page is 512 bytes. The logical address space is mapped onto a physical memory of 32 frames.

Answer the following questions.

[2 + 2 + 2 + 2 + 2]

Question	Your Answer
How many bits are required to represent a page number?	
How many bits are required to represent page offset?	
How many bits are there in the logical address?	
How many bits are required to represent a frame number?	
How many bits are there in the physical address?	

- (f) Consider the page reference string. Find total page faults using optimal page replacement algorithm, where the number of frames are 3. [ 5]

1 2 3 2 1 5 2 1 6 2 5 6 3 1 3 6 1 2 4 3



ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Q.2. Give short answers of the following:

(10x2=20)

- ✓I. What is belady anomaly in page replacement.
- ✓II. Draw state diagram of 3 state process model?
- ✓III. Difference between long-term scheduler and short-term scheduler?
- ✓IV. Explain context switching?
- ✓V. Define external fragmentation?
- ✓VI. Define race condition with example.?
- ✓VII. What is the process address space?
- ✓VIII. What is Page Fault?
- ✓IX. Define turn-around time?
- ✓X. Define critical section.?

Q#3:

(30)

Consider the following processes:

Process	Burst Time
P <sub>1</sub>	8
P <sub>2</sub>	7
P <sub>3</sub>	12
P <sub>4</sub>	5
P <sub>5</sub>	2

- ✓(a) Use First Come, First Served (FCFS) algorithm to answer the following questions.

Draw the Gantt chart of FCFS schedule. [3]



# UNIVERSITY OF THE PUNJAB

Fifth Semester 2013

Roll NO. \_\_\_\_\_

Examination: B.S. 4 Years Programme

PAPER: Operating Systems (CMP)

TIME ALLOWED: 2 hrs. & 30 mins.

Course Code: IT-306

MAX. MARKS: 50

Attempt This Paper on Separate Answer Sheet provided.

## Part-II (Short Question)

### QUESTION # 2

[20 marks]

1. What is difference between microkernel and layered operating system structures?
2. In multithreaded application Many-to-One model is implemented. How does this application handle the threads?
3. Why every thread has its own stack?
4. What is zombie state of a process?
5. Name the inter-process communication tools used in UNIX operating system?
6. What does a child process inherits from its parent process?
7. What are the different techniques for the evaluation of scheduling algorithms?
8. Mention the three problems that may be caused by the wrong initialization or placement of wait () and signal () operations in the use of semaphores.
9. What do you mean by a busy waiting semaphore or spin lock?
10. In a 64 bit machine, with 16GB RAM and 8KB page size. How many entries will there be in the page if it is an inverted page table?

## Part-III (Subjective)

### QUESTION # 3

[10 marks]

Consider the following set of Processes, with the length of CPU time given in microseconds. Draw the Gantt chart, using Round Robin Algorithm when Time Slice = 3 microseconds. Also compute the waiting and turnaround times of each process.

Process	Arrival Time	Burst Time
P1	0	7
P2	4	5
P3	5	4
P4	7	4
P5	12	6
P6	17	3

**QUESTION # 4****[10 marks]**

Consider three resource types in a system with following number of instances.

A (14 instances), B (10 instances), C (20 instances)

System State is as shown below, find safe sequence using Bankers algorithms.

PROCESS	MAX			ALLOCATION			AVAILABLE		
	A	B	C	A	B	C	A	B	C
P0	6	10	14	0	2	0	4	6	6
P1	4	4	6	0	0	4			
P2	4	0	18	4	0	6			
P3	4	4	4	2	2	4			
P4	6	6	8	4	0	0			

**QUESTION # 5****[2x5 = 10 marks]**

1. Consider a system with 64-bit logical address. This system implements paging with 2 KB page size. Compute: lengths of *p* and *d* fields in the logical address.
2. In a paging system, logical address space is 4 GB and the page size is 4 KB. Available physical memory is 16 GB. Compute: length of logical address and length of *f* field in the physical address.
3. If the hit-ratio to a TLB is 98%, and it takes 10 nanoseconds (nsec) to search the TLB and 100 nsec to access the main memory, then what must be the Effective Memory Access Time in nanoseconds?
4. If the total number of available frame is 50, and there are 2 processes; one of 50 pages and the other of 35 pages, then how much memory would be proportionally allocated to each of these processes?
5. What is meant by Belady's Anomaly? Why stack based algorithms do not suffer from Belady's Anomaly?



# UNIVERSITY OF THE PUNJAB

Fifth Semester 2014

Roll NO. \_\_\_\_\_

Examination: B.S. 4 Years Programme

PAPER: Operating Systems (CMP)

TIME ALLOWED: 2 hrs. & 30 mins.

Course Code: IT-306

MAX. MARKS: 50

Attempt This Paper on Separate Answer Sheet provided.

## Part-II (Short Question)

### QUESTION # 2

[5x4=20 marks]

1. Explain the difference between layered and module based operating system structure?
2. Describe the difference among short-term, medium term, and long term scheduling.
3. What are the two differences between kernel level thread and user level thread? Under what circumstance is one type better than other?
4. In a multithreaded application, if we implement Many-to-Many model then how does this application handle the threads?
5. Mention the three problems that may be caused by the wrong initialization or placement of wait ( ) and signal ( ) operations in the use of semaphores.

## Part-III (Subjective)

### QUESTION # 3

[10 marks]

Consider the following set of Processes, with the length of CPU time given in microseconds. Draw the Gantt chart, using **Round Robin Algorithm** when Time Slice = 4 microseconds. Also compute the waiting and turnaround times of each process.

Process	Arrival Time	Burst Time
P1	0	8
P2	3	6
P3	6	8
P4	10	10
P5	15	7

**QUESTION # 4****[10 marks]**

Consider three resource types in a system with following number of instances.

A (8 instances), B (5 instances), C (10 instances)

System State is as shown below, find safe sequence using Bankers algorithms.

PROCESS	MAX			ALLOCATION			AVAILABLE		
	A	B	C	A	B	C	A	B	C
P0	3	5	7	0	1	0	3	3	3
P1	2	2	3	0	0	2			
P2	2	0	9	2	0	3			
P3	2	2	2	1	1	2			
P4	3	3	4	2	0	0			

**QUESTION # 5****[2x5 = 10 marks]**

1. Consider a system with 64-bit logical address. This system implements paging with 1 KB page size. Compute: lengths of *p* and *d* fields in the logical address.
2. In a paging system, logical address space is 8 GB and the page size is 2 KB. Available physical memory is 46 GB. Compute: length of logical address and length of *f* field in the physical address.
3. If the hit-ratio to a TLB is 90%, and it takes 20 nanoseconds (nsec) to search the TLB and 200 nsec to access the main memory, then what must be the Effective Memory Access Time in nanoseconds?
4. If the total number of available frame is 60, and there are 2 processes; one of 50 pages and the other of 40 pages, then how much memory would be proportionally allocated to each of these processes?
5. What is meant by Thrashing?



# UNIVERSITY OF THE PUNJAB

Fifth Semester 2015

Roll NO. \_\_\_\_\_

Examination: B.S. 4 Years Programme

PAPER: Operating Systems (CMP)

TIME ALLOWED: 2 hrs. & 30 mins.

Course Code: IT-306

MAX. MARKS: 50

Attempt This Paper on Separate Answer Sheet provided.

## Part-II (Short Question)

### QUESTION # 2

[5x4=20 marks]

1. What are the main differences between operating systems for mainframe computers and personal computers?
2. Why is it important for the scheduler to distinguish I/O-bound programs from CPU-bound programs?
3. What are the four necessary conditions for a deadlock to occur?
4. Explain the difference between internal and external fragmentation.
5. What is the copy-on-write feature and under what circumstances is it beneficial to use this feature?

## Part-III (Subjective)

### QUESTION # 3

[10 marks]

Consider the following set of Processes, with the length of CPU time given in microseconds. Draw the Gantt chart, using **Round Robin Algorithm** when Time Slice = 3 microseconds. Also compute the waiting and turnaround times of each process.

Process	Arrival Time	Burst Time
P0	0	7
P1	4	7
P2	6	9
P3	11	8
P4	14	6

**QUESTION # 4****[10 marks]**

Consider three resource types in a system with following number of instances.

A (16 instances), B (10 instances), C (10 instances)

System State is as shown below, find safe sequence using Bankers algorithms.

PROCESS	MAX			ALLOCATION			AVAILABLE		
	A	B	C	A	B	C	A	B	C
P1	6	10	7	0	2	0	6	6	3
P2	4	4	3	0	0	2			
P3	4	0	9	4	0	3			
P4	4	4	2	2	2	2			
P5	6	6	4	4	0	0			

**QUESTION # 5****[2x5 = 10 marks]**

1. Consider a system with 33-bit logical address. This system implements paging with 2 KB page size. Compute: lengths of  $p$  and  $d$  fields in the logical address.
2. In a paging system, logical address space is 16 GB and the page size is 4 KB. Available physical memory is 8 GB. Compute: length of logical address and length of  $f$  field in the physical address.
3. In a paging system, logical address space is 4 GB and the page size is 4 KB. Page table entry size is of 32-bit. How many levels of paging will be there?
4. If the hit ratio to a TLB is 95 %, and it takes 30 nanoseconds (nsec) to search the TLB and 300 nsec to access the main memory, then what must be the Effective Memory Access Time in nanoseconds?
5. If the total number of available frames is 120, and there are 3 processes; one of 50 pages, second of 60 page and the third of 40 pages, then how much memory would be proportionally allocated to each of these processes?





# UNIVERSITY OF THE PUNJAB

Fifth Semester 2016  
Examination: B.S. 4 Years Programme

Roll No. 10253

PAPER: Operating Systems (CMP)  
Course Code: IT-306

TIME ALLOWED: 2 hrs. & 30 mins.  
MAX. MARKS: 50

Attempt this Paper on Separate Answer Sheet provided.

## SUBJECTIVE TYPE

### Part-II

A very short answer is required for each of the following questions. [10 x 2 = 20]

1. What is the difference between a library call and a system call? (Lap Top)
2. How do user applications use the functionality of an operating system?
3. What is meant by Memory-protection?
4. What is meant by dual-mode operation?
5. What is the function of device queue?
6. What is the purpose of short term scheduler?
7. Can we apply compaction if we have implemented load time address binding? Provide reason that supports your answer.
8. In which memory management technique, system suffers from Internal Fragmentation? *Paging*
9. What are the criteria for a good solution of critical section problem?
10. What is meant by overlaying?

### Part-III

Answer the following questions briefly. [6 x 5 = 30]

1. Draw a resource allocation graph that contains multiple instances per resource type and a cycle but still it is deadlock free. *AO*
2. Differentiate a process with a thread?
3. What is address binding? How many types of address binding exist in an operating system?
4. What are the necessary conditions for the deadlock to exist? *AO*
5. Determine the system state for the following resource allocation state by using Banker's algorithm.

	Allocation				Max			
	A	B	C	D	A	B	C	D
P0	4	1	0	2	10	1	6	6
P1	4	5	1	2	8	8	3	4
P2	0	1	0	2	0	2	0	2
P3	0	2	2	2	0	2	2	10
P4	6	1	1	0	18	1	8	0
P5	0	1	2	4	0	1	7	14
	<u>14 11 6 12</u>							

Available  
A B C D  
6 1 8 2  
14 11 6 12  
20 12 14 14 = Total Resources

6. Consider a computer system with a 32-bit logical address space and with 1 KB page size. Suppose that the maximum physical memory size is 16 GB, and the system is byte-addressable. Let paging be implemented for the system. Give answer to following five questions:
  - a. How many bits for p and d are there in the logical address?
  - b. How many pages are there in the process?
  - c. How many frames are there in the memory?
  - d. What is the size of the page table if one entry in the page table is of 4 bytes?
  - e. How many levels of paging will be required for the above scenario?



UNIVERSITY OF THE PUNJAB

Roll No. ....

Fifth Semester 2017

Examination: B.S. 4 Years Programme

PAPER: Operating Systems (CMP)

TIME ALLOWED: 30 mins.

Course Code: IT-306

MAX. MARKS: 10

Attempt this Paper on this Question Sheet only.

**OBJECTIVE TYPE**

Question # 1 Multiple Choice Questions:

(10 marks)

1. \_\_\_\_\_ is not the component of OS.
  - a. Thread management
  - b. Networking
  - c. Protection system
  - d. Command-line interpreter
2. A PCB contains information associated with a specific process that is used by
  - a. OS to control the process.
  - b. CPU to execute a process
  - c. Process to terminate
  - d. None of above
3. \_\_\_\_\_ controls the degree of multiprogramming.
  - a. Long term scheduler
  - b. Short term scheduler
  - c. Medium term scheduler
  - d. Dispatcher
4. All Threads with in a process share the \_\_\_\_\_ address space
  - a. Same
  - b. Different
5. When several processes access the same data concurrently and the outcome of the execution depends on the particular order in which the access takes place, is called
  - a. Dynamic condition
  - b. Race condition
  - c. Essential condition
  - d. Critical condition
6. We can always prevent a deadlock from happening by providing for additional resources of the same kind
  - a. True
  - b. False
7. Which of the following are examples of non-preemptable resources:
  - a. CPU
  - b. Printer
  - c. Memory
  - d. CD writer
  - e. None of the above
8. How many level of paging will be implemented, if the system has 36bit logical address, page size is 4KB and Main memory is 4MB?
  - a. 2 level
  - b. 3 level
  - c. 4 level
  - d. 5 level
9. A solution to the problem of External fragmentation is :
  - a. Swapping
  - b. Compaction
  - c. Larger memory space
  - d. None of these
10. A solution to the problem of External fragmentation is :
  - a. Swapping
  - b. Compaction
  - c. Larger memory space
  - d. None of these



# UNIVERSITY OF THE PUNJAB

Fifth Semester 2017  
Examination: B.S. 4 Years Programme

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Course Code: IT-306

TIME ALLOWED: 2 hrs. & 30 mins.  
MAX. MARKS: 50

Attempt this Paper on Separate Answer Sheet provided.

Question # 2 Short Questions **SUBJECTIVE TYPE** 5 x 4 = 20 marks

- Differences between scheduler and dispatcher?
- Mention four reasons for process creation?
- States the Critical Section Problem. What requirements must a solution to the critical section problem satisfy?
- What is the difference between Load Time Dynamic Linking VS Run Time Dynamic Linking?

Question # 3 Schedule the following processes using RR. The processes P1, P2 and P3 have arrived at time units 0, 1 and 2 respectively. The number inside the parenthesis indicates the time units for CPU and I/O bursts. Assume a time quantum of 4 time units. **10 marks**

- Create Gantt chart
- Calculate turnaround time

Process	CPU Burst	I/O Burst	CPU Burst	I/O Burst	CPU Burst
P1	3	6	2	4	5
P2	5	4	3		
P3	6	8	5	7	2

Question # 4 **10 marks**

- Differences between zombie and orphan processes?
- Give the output of the given code snippet.

```
int main ( intargc, char * argv [ ] )
{
    intcpid, status;
    cpid = fork();
    printf("start execution");
    if (cpid> 0)
    {
        wait(&status);
        fork();
        printf("Between Creation");
        fork();
        printf("Inside Parent Process\n");
        printf("Bye\n");
    }
    else
    {
        printf("Inside Child Process\n");
        printf("Good Bye\n");
        fork();
        exit(0);
    }
    return 0;
}
```

Question # 5 **10 marks**  
Consider three resource types in a system with following number of instances.

- A (9 instances)
- B (3 instances)
- C (6 instances)

System State is as shown below, find safe sequence (if any) using Bankers & Safety algorithm. In case if there is no safe sequence mention which process (es) are involved in dead lock.

PROCESS	MAX			ALLOCATION		
	A	B	C	A	B	C
P1	3	2	2	1	0	0
P2	6	1	3	6	1	2
P3	3	1	4	2	1	1
P4	4	2	2	0	0	2



**UNIVERSITY OF THE PUNJAB**

Roll No. ....

**Fifth Semester 2018**

**Examination: B.S. 4 Years Programme**

**PAPER: Operating Systems (CMP)**  
**Course Code: IT-306**

**TIME ALLOWED: 30 mins.**  
**MAX. MARKS: 10**

*Attempt this Paper on this Question Sheet only.*

**OBJECTIVE TYPE**

Part-I

Select the best option for the following multiple choice questions.

[10]

1. What is operating system?
  - a) collection of programs that manages hardware resources
  - b) system service provider to the application programs
  - c) link to interface the hardware and application programs
  - d) all of the mentioned
  
2. To access the services of operating system, the interface is provided by the
  - a) system calls
  - b) API
  - c) library
  - d) assembly instructions
  
3. Which one of the following is not true?
  - a) kernel is the program that constitutes the central core of the operating system
  - b) kernel is the first part of operating system to load into memory during booting
  - c) kernel is made of various modules which cannot be loaded in running operating system
  - d) kernel remains in the memory during the entire computer session
  
4. In operating system, each process has its own
  - a) address space and global variables
  - b) open files
  - c) pending alarms, signals and signal handlers
  - d) all of the mentioned
  
5. A process stack does not contain
  - a) function parameters
  - b) local variables
  - c) return addresses
  - d) PID of child process
  
6. Which module gives control of the CPU to the process selected by the short-term scheduler?
  - a) dispatcher
  - b) interrupt
  - c) scheduler
  - d) none of the mentioned

**P.T.O.**

7. Spinlocks are :

- a) CPU cycles wasting locks over critical sections of programs
- b) locks that avoid time wastage in context switches
- c) locks that work better on multiprocessor systems
- d) All of these

8. The number of resources requested by a process :

- a) must always be less than the total number of resources available in the system
- b) must always be equal to the total number of resources available in the system
- c) must not exceed the total number of resources available in the system
- d) must exceed the total number of resources available in the system

9. Deadlock prevention is a set of methods :

- a) to ensure that at least one of the necessary conditions cannot hold
- b) to ensure that all of the necessary conditions do not hold
- c) to decide if the requested resources for a process have to be given or not
- d) to recover from a deadlock

10. If one thread opens a file with read privileges then

- a) other threads in the another process can also read from that file
- b) other threads in the same process can also read from that file
- c) any other thread cannot read from that file
- d) all of the mentioned



# UNIVERSITY OF THE PUNJAB

Fifth Semester 2018  
Examination: B.S. 4 Years Programme

Roll No. 015567

PAPER: Operating Systems (CMP)  
Course Code: IT-306

TIME ALLOWED: 2 hrs. & 30 mins.  
MAX. MARKS: 50

Attempt this Paper on Separate Answer Sheet provided.

## SUBJECTIVE TYPE

### Part-II

A very short answer is required for each of the following questions. [10 x 2 = 20]

1. Which system call is used to create a process in UNIX? *Process control Fork()*
2. How hardware devices use the functionality of an operating system?
3. What is meant by CPU-protection?
4. What is meant by dual-mode operation?
5. What is the function of ready queue?
6. What is the difference between Long Term Scheduler and Short Term Scheduler?
7. In which memory management technique process can be divided into equal parts? *Paging*
8. In which memory management technique, system suffers from External Fragmentation? *segmentation*
9. What is meant by critical section?
10. What is meant by race condition?

### Part -III

Answer the following questions briefly. [6 x 5 = 30]

1. Explain five states process model.
2. What are the different multithreading models?
3. Name the different techniques used for process synchronization.
4. What are the necessary conditions for the deadlock to exist?
5. Determine the system state for the following resource allocation state by using Banker's algorithm.

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	2	1	0	1	5	1	6	3	3	1	8	1
P1	2	5	1	1	4	8	3	2				
P2	0	1	0	1	0	2	0	1				
P3	0	2	2	1	0	2	2	5				
P4	3	1	1	0	9	1	8	0				
P5	0	1	2	2	0	1	7	7				

6. Consider a computer system with a 24-bit logical address space and with 2 KB page size. Suppose that the maximum physical memory size is 64 MB, and the system is byte-addressable. Let paging be implemented for the system. Give answer to following five questions:
  - a. How many bits for p and d are there in the logical address?
  - b. How many pages are there in the process?
  - c. How many frames are there in the memory?
  - d. What is the size of the page table if one entry in the page table is of 4 bytes?
  - e. How many levels of paging will be required for the above scenario?

*2k/2*



# UNIVERSITY OF THE PUNJAB

Fifth Semester – 2019

Examination: B.S. 4 Years Program

Roll No. ....

PAPER: Operating Systems (CMP)  
Course Code: IT-306 Part – II

MAX. TIME: 2 Hrs. 45 Min.  
MAX. MARKS: 50

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

### Q.2. Questions with short answers.

(10 x 2 = 20)

- I. ✓ What is Convay Effect?
- II. ✓ Explain different states of process?
- III. ✓ Difference between long-term scheduler and short-term scheduler?
- IV. ✓ Explain deadlock conditions?
- V. ✓ Define dispatcher latency?
- VI. ✓ Define demand paging?
- VII. ✓ What is the process address space?
- VIII. ✓ Difference between paging and segmentation?
- IX. ✓ Define turn-around time?
- X. ✓ Define two operations of semaphore?



### Q.3. Questions with long answers.

(3 x 10 = 30)

Solve the following question using banker's algorithm?

	ALLOCATION				MAX				AVAILABLE			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	0	1	0	0	0	5	1	3	1	3	2	2
P1	1	0	0	0	1	2	5	2				
P2	1	0	5	2	2	0	5	2				
P3	0	1	3	1	0	2	5	2				
P4	0	0	1	2	0	3	5	3				

- i. What is the content of the need matrix? (5)
- ii. Is the system in a safe state? (5)
- (b) Find the average waiting time using Shortest Remaining time method? (10)

Process	Arrival Time	Burst Time
P1	0.0	7
P2	2.0	4
P3	4.0	1
P4	5.0	4

(c) Given memory partitions of 100K, 600K, 200K, 300K, and 500K (in order), how would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 409K, 236K, 125K, and 514K (in order)?

- 1. Also define First-fit, Best-fit, and Worst-fit algorithms. (6)
- 2. Which algorithm makes the most efficient use of memory? (4)

Handwritten notes and calculations:

- 9' 25
- 71 5
- 70 66 4
- Diagram: P1 | P2 | P3 | P4 | P1
- Below diagram: 2, 4, 5, 7, 11

