MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)
(ISO/IEC - 27001 - 2005 Certified)

WINTER – 2022 EXAMINATION
MODEL ANSWER

Subject: Operating System **Subject Code:** **22516**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for anyequivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.
8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

<table>
<tr><th>Q. No</th><th>Sub Q.N.</th><th>Answer</th><th>Marking Scheme</th></tr>
<tr><td>1.</td><td>a)

Ans.</td><td>Attempt any <u>FIVE</u> of the following:
Differentiate between Multi programmed and Multitasking operating system (Any two points)
<table>
<tr><th>Features</th><th>Multiprogramming</th><th>Multitasking</th></tr>
<tr><td>Basic</td><td>It allows multiple programs to utilize the CPU simultaneously.</td><td>A supplementary of the multiprogramming system also allows for user interaction.</td></tr>
<tr><td>Mechanism</td><td>Based on the context switching mechanism.</td><td>Based on the time-sharing mechanism.</td></tr>
<tr><td>Objective</td><td>It is useful for reducing/decreasing</td><td>It is useful for running multiple processes at the</td></tr>
</table>
</td><td>10
2M

<i>Any two relevant points, 1M each</i></td></tr>
</table>

	CPU idle time and increasing throughput as much as possible.	same time, effectively increasing CPU and system throughput.
Execution	When one job or process completes its execution or switches to an I/O task in a multi-programmed system, the system momentarily suspends that process. It selects another process from the process scheduling pool (waiting queue) to run.	In a multiprocessing system, multiple processes can operate simultaneously by allocating the CPU for a fixed amount of time.
CPU Switching	In a multiuser environment, the CPU switches between programs/processes quickly.	In a single-user environment, the CPU switches between the processes of various programs.
Timing	It takes maximum time to execute the process.	It takes minimum time to execute the process.

b) **List any four services provided by O.S.** **2M**

Ans.

- User Interface
- Program Execution
- I/O Operation
- File system Manipulation
- Communication
- Error Detection
- Resource Allocation
- Accounting
- Protection and security

½ M each for any 4 services

c)

Ans.

Define : Process, PCB

Process:-A process is a program in execution. Process is also called as job, task or unit of work.

PCB:-Process Control Block is a data structure that contains information of the process related to it. The process control block is also known as a task control block, entry of the process table, etc.

2M

Correct Definition 1M each

d)

Ans.

Define CPU and I/O burst cycle.

CPU burst cycle: It is a time period when process is busy with CPU.

I/O burst cycle: It is a time period when process is busy in working with I/O resources.

2M

Correct Definition 1M each

e)

Ans.

Differentiate between paging and segmentation.

Parameters	**Paging**	**Segmentation**
Individual Memory	In Paging, we break a process address space into blocks known as pages.	In the case of Segmentation, we break a process address space into blocks known as sections/segments.
Memory Size	The pages are blocks of fixed size.	The sections/segments are blocks of varying sizes.
Accountability	The OS divides the available memory into individual pages.	The compiler mainly calculates the size of individual segments, their actual address as well as virtual address.
Speed	This technique is comparatively much faster in accessing memory.	This technique is comparatively much slower in accessing memory than Paging.
Size	The available memory determines the individual page sizes.	The user determines the individual segment sizes.
Fragmentation	The Paging technique may underutilize some of the pages- thus	The Segmentation technique may not use some of the memory

2M

Any two relevant differences – 1M each

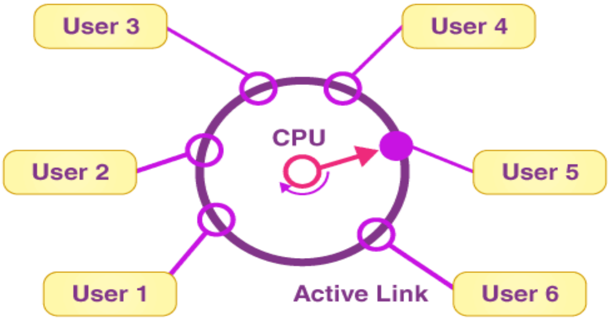
<table>
<tr><td></td><td></td><td>
<table>
<tr><td></td><td>leading to internal fragmentation.</td><td>blocks at all. Thus, it may lead to external fragmentation.</td></tr>
<tr><td>Logical Address</td><td>A logical address divides into page offset and page number in the case of Paging.</td><td>A logical address divides into section offset and section number in the case of Segmentation.</td></tr>
<tr><td>Data Storage</td><td>In the case of Paging, the page table leads to the storage of the page data.</td><td>In the case of Segmentation, the segmentation table leads to the storage of the segmentation data.</td></tr>
</table>
</td><td></td></tr>
<tr><td></td><td>f)

Ans.</td><td>Write syntax of following commands-
(i) Kill
(ii) Sleep
i) kill
Syntax: kill Pid

ii) sleep
Syntax: sleep NUMBER[SUFFIX]…
sleep OPTION</td><td>2M

<i>1M for each correct syntax</i></td></tr>
<tr><td></td><td>g)
Ans.</td><td>List any four file operations.
Creating a file
Writing a file:
Reading a file:
Repositioning within a file
Deleting a file
Appending new information to the end of the file
Renaming an existing file.
Creating copy of a file, copy file to another I/O device such as printer or display</td><td>2M

<i>Any four operations ½ M each</i></td></tr>
<tr><td>2.</td><td>
a)
Ans.</td><td>Attempt any <u>THREE</u> of the following:
Explain Time sharing O.S.
In time sharing system, the CPU executes multiple jobs by switching among them. The switches occur so frequently that the users can interact with each program while it is running. It includes an</td><td>12
4M</td></tr>
</table>

		interactive computer system which provides direct communication between the user and the system. A time-sharing system allows many users to share the computer resources simultaneously. The time-sharing system provides the direct access to many users where CPU time is divided among all the users on scheduled basis. The operating system allocates a time slice to each user. When this time is expired, it passes control to the next user on the system. The time allowed is extremely small and the users are given the impression that each of them has their own CPU and they are the sole owner of the CPU. In this time slice each user gets attention of the CPU. The objective of time-sharing system is to minimize response time of process. **Example: The concept of time-sharing system is shown in figure:**  In above figure, the user 5 is active but user 1, user 2, user 3, and user 4 are in waiting state whereas user 6 is in ready status.	*Relevant Explanation 4M*
	b) **Ans.**	**Describe any two components of O.S.** **List of System Components:** **1. Process management** **2. Main memory management** **3. File management** **4. I/O system management** **5. Secondary storage management** **1.Process Management:** A program is a set of instructions. When CPU is allocated to a program, it can start its execution. A program in execution is a process. A word processing program run by a user on a PC is a process. A process needs various system resources including CPU time, memory, files and I/O devices to complete the job execution. These resources can be given to the process when it is created or allocated to it while it is running.	**4M** *Description of any two components of OS 2M each*

The operating system responsible for the following **activities** in connection with process management:

- Creation and deletion of user and system processes.
- Suspension and resumption of processes.
- A mechanism for process synchronization.
- A mechanism for process communication.
- A mechanism for deadlock handling.

2. Main-Memory Management

Main memory is a large array of words or bytes, ranging in size from hundreds of thousands to billions. Each word or byte has its own address. Main memory is a repository of quickly accessible data shared by the CPU and I/O devices. The central processor reads instructions from main memory during the instruction fetch cycle and both reads and writes data from main memory during the data fetch cycle. The main memory is generally the only large storage device that the CPU is able to address and access directly.

The operating system responsible for the following **activities** in connection with main memory s management:

- Keeping track of which parts of memory are currently being used and by whom.
- Deciding which processes (or parts thereof) and data to move into and out of memory. 3. Allocating and deallocating memory space as needed.

3. File Management

A file is a collected of related information defined by its creator. Computer can store files on the disk (secondary storage), which provide long term storage. Some examples of storage media are magnetic tape, magnetic disk and optical disk. Each of these media has its own properties like speed, capacity, and data transfer rate and access methods. A file system normally organized into directories to ease their use. These directories may contain files and other directions.

The operating system responsible for the following **activities** in connection with file management:

- The creation and deletion of files.
- The creation and deletion of directions.
- The support of primitives for manipulating files and directions.
- The mapping of files onto secondary storage.
- The backup of files on stable storage media.

4. I/O device Management

Input / Output device management provides an environment for the better interaction between system and the I / O devices (such as printers, scanners, tape drives etc.). To interact with I/O devices in an effective manner, the operating system uses some special programs known as device driver. The device drivers take the data that operating system has defined as a file and then translate them into streams of bits or a series of laser pulses (in regard with laser printer).

The I/O subsystem consists of several components:

- A memory management component that includes buffering, caching, spooling
- A general device driver interface
- Drivers for specific hardware devices

5. Secondary-Storage Management

The computer system provides secondary storage to back up main memory. Secondary storage is required because main memory is too small to accommodate all data and programs, and the data that it holds is lost when power is lost. Most of the programs including compilers, assemblers, word processors, editors, and formatters are stored on a disk until loaded into memory. Secondary storage consists of tapes drives, disk drives, and other media.

The operating system is responsible for the following **activities** in connection with disk management:

- Free space management
- Storage allocation
- Disk scheduling.

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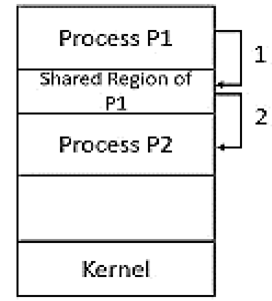
c) **Explain shared memory model of Interprocess communication (IPC)**

4M

Ans. **Inter-process communication:** Cooperating processes require an Inter- process communication (IPC) mechanism that will allow them to exchange data and information.

Explanation 3M
Diagram 1M

Shared memory



Shared Memory System

- In this, all processes who want to communicate with other processes can access a region of the memory residing in an address space of a process creating a shared memory segment.
- All the processes using the shared memory segment should attach to the address space of the shared memory. All the processes can exchange information by reading and/or writing data in shared memory segment.
- The form of data and location are determined by these processes who want to communicate with each other.
- These processes are not under the control of the operating system.
- The processes are also responsible for ensuring that they are not writing to the same location simultaneously.
- After establishing shared memory segment, all accesses to the shared memory segment are treated as routine memory access and without assistance of kernel.

d)
Ans.

Describe different scheduling criteria.

4M

Any four scheduling criteria -1M each

- **CPU utilization: -** In multiprogramming the main objective is to keep CPU as busy as possible. CPU utilization can range from 0 to 100 percent.

- **Throughput: -** It is the number of processes that are completed per unit time. It is a measure of work done in the system. When CPU is busy in executing processes, then work is being done in the system. Throughput depends on the execution time required for any process.

- **Turnaround time: -**The time interval from the time of submission of a process to the time of completion of that process is called as turnaround time. It is the sum of time period spent waiting to get into the memory, waiting in the ready queue, executing with the CPU, and doing I/O operations.

- **Waiting time: -** It is the sum of time periods spent in the ready queue by a process. When a process is selected from job pool, it is loaded into the main memory. A process waits in ready queue till CPU is allocated to it.

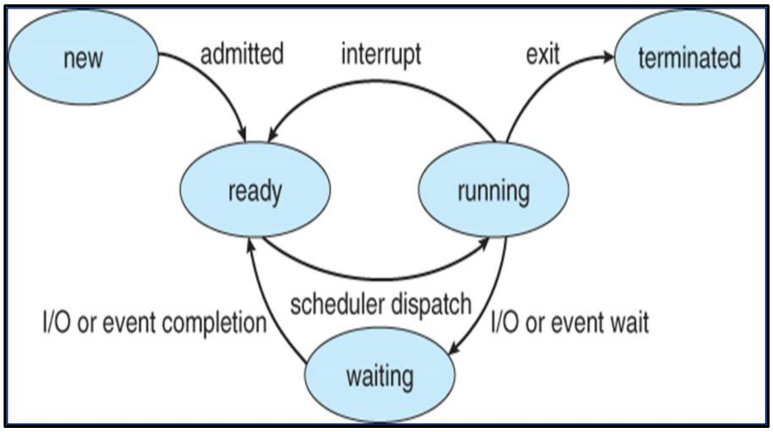
3. **Attempt any THREE of the following:** **12**

a) **Draw and explain process state diagram.** **4M**

Ans. Different process states are as follows:

1. New
2. Ready
3. Running
4. Waiting
5. Terminated

Process state diagram 2M
Explanation 2M

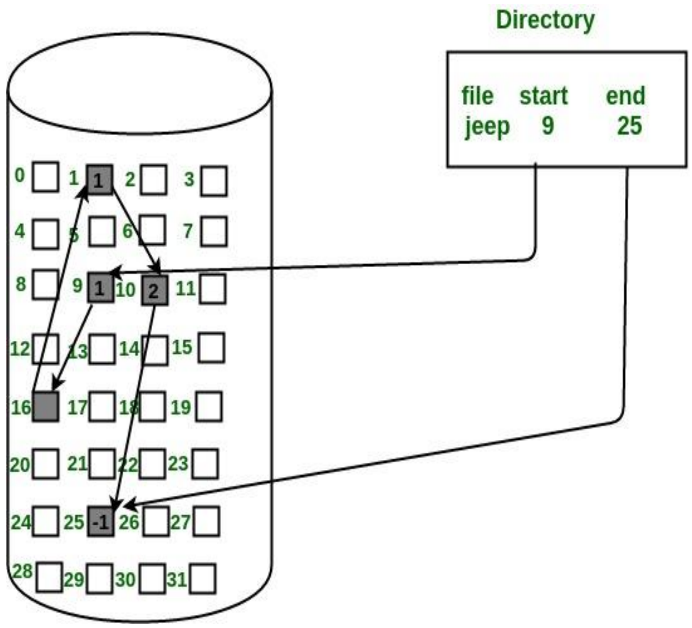


New: When a process enters into the system, it is in new state. In this state a process is created. In new state the process is in job pool.

Ready: When the process is loaded into the main memory, it is ready for execution. In this state the process is waiting for processor allocation.

		Running: When CPU is available, system selects one process from main memory and executes all the instructions from that process. So, when a process is in execution, it is in running state. In single user system, only one process can be in the running state. In multiuser system, there can be multiple processes which are in the running state. **Waiting State**: When a process is in execution, it may request for I/O resources. If the resource is not available, process goes into the waiting state. When the resource is available, the process goes back to ready state. **Terminated State:** When the process completes its execution, it goes into the terminated state. In this state the memory occupied by the process is released.	
	b) **Ans.**	**Describe conditions for deadlock prevention.** By ensuring that at least one of below conditions cannot hold, we can prevent the occurrence of a deadlock. **1.Mutual Exclusion:** The mutual-exclusion condition must hold for non-sharable resources. Sharable resources do not require mutually exclusive access, thus cannot be involved in a deadlock. **2.Hold and Wait:** One way to avoid this Hold and Wait is when a process requests a resource; it does not hold any other resources. •One protocol that can be used requires each process to request and be allocated all its resources before it begins execution. •Another protocol that can be used is, to allow a process to request resources only when the process has none. A process may request some resources and use them. Before it requests any additional resources, it must release all the resources that are currently allocated to it. **3.No Preemption:** If a process that is holding some resources requests another resource that cannot be immediately allocated to it, then all resources currently being held are preempted. That is these resources are implicitly	**4M** ***Any four conditions 1M each***

		released. The preempted resources are added to the list of resources for which the process is waiting. Process will be restarted only when all the resources i.e. its old resources, as well as the new ones that it is requesting will be available. **4.Circular Wait** Circular-wait condition never holds is to impose a total ordering of all resource types, and to require that each process requests resources in an increasing order of enumeration. Let R = {R1, R2, ..., Rn} be the set of resource types. We assign to each resource type a unique integer number, which allows us to compare two resources and to determine whether one precedes another in our ordering. Formally, define a one-to-one function F: R _ N, where N is the set of natural numbers.	
	c) **Ans.**	**Explain fixed size memory partitioning.** **Fixed Size Memory Partitioning (Static)** • Memory is divided into number of fixed size partitions, which is called as fixed or static memory partitioning. • Each partition contains exactly one process. • The number of programs to be executed depends on number of partitions. • When the partition is free, a selected process from the input queue is loaded into the free partition. • When the process terminates, the partition becomes available for another process. • The operating system keeps a table indicating parts of memory which are available and which are occupied. • Initially, all memory is available for user processes and it is considered as one large block of available memory, a hole. • When a process arrives, large enough hole of memory is allocated to the processes. •	**4M** ***Correct Explanation 4M***
	d) **Ans.**	**Explain linked file allocation method.** **Linked Allocation:** • This allocation is on the basis of an individual block. Each block contains a pointer to the next block in the chain. • The disk block can be scattered anywhere on the disk.	**4M** ***Correct explanation 4M,***

		- The directory contains a pointer to the first and the last blocks of the file. - To create a new file, simply create a new entry in the directory. - The following figure shows the linked allocation.  - There is no external fragmentation since only one block is needed at a time. - The size of a file need not be declared when it is created. - A file can continue to grow as long as free blocks are available - This method is used only for a sequential access files - This method requires more space to store pointers - So instead of blocks, clusters are used for allocation but this creates internal fragmentation.	***Diagram Optional***
4.	**a)**	**Attempt any <u>THREE</u> of the following:** **Compare between command line and Graphical user interface. (Any four points)**	**12** **4M**

Ans.

Parameter	**Command Line Interface(CLI)**	**Graphic User Interface(GUI)**
Definition	Interaction is by typing commands	Interaction with devices is by graphics and visual components and icons
Understanding	Commands need to be memorized	Visual indicators and icons are easy to understand
Memory	Less memory is required for storage	More memory is required as visual components are involved.
Working Speed	Use of keyboard for commands makes CLI quicker.	Use of mouse for interaction makes it slow
Resources used	Only keyboard	Mouse and keyboard both can be used
Accuracy	High	Comparatively low
Flexibility	Command line interface does not change, remains same over time	Structure and design can change with updates

Any four points 1M each

b) **Write any four systems call related to file management.** **4M**

Ans. **System calls related to file management are:**

1. create new file
2. delete existing file
3. open file
4. close file
5. create directories
6. delete directories
7. read, write, reposition in file
8. getfile attributes
9. set file attributes

Any 4 system calls 1M each

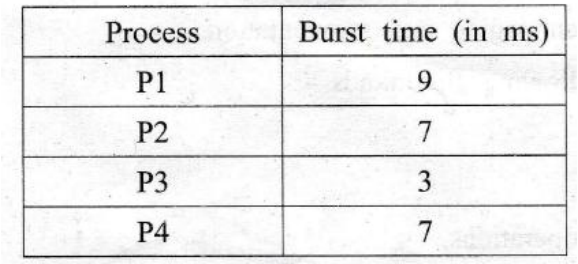
c) **Compare between Long term and short term scheduler. (Any four points)** **4M**

Ans.

Any four points 1M each

Sr. No	**Long Term Scheduler**	**Short Term Scheduler**
1	It is job scheduler	It is CPU scheduler
2	It selects processes from job pool and loads them into memory for execution	It selects processes from ready queue which are ready to execute and allocates CPU to one of them
3	Access job pool and ready queue	Access ready queue and CPU
4	It executes much less frequently. It executes when memory has space to accommodate new process.	It executes frequently. It executes when CPU is available for allocation
5	Speed is less than short term scheduler	Speed is fast
6	It controls the degree of multiprogramming	It provides lesser control over degree of multiprogramming
7	It chooses a good process that is a mix-up of input/output bound and CPU bound.	It chooses a new process for a processor quite frequently.

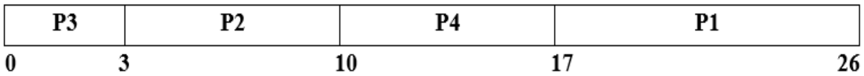
d) **Solve given problem by using SJF and FCFS scheduling algorithm using Gantt chart. Calculate the average waiting time for each algorithm** **4M**



Process	Burst time (in ms)
P1	9
P2	7
P3	3
P4	7

Ans.

Gantt Chart SJF

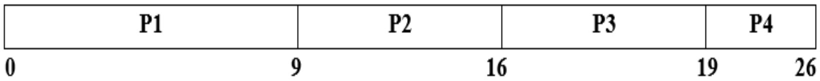


Waiting Time
P1=17
P2=3
P3=0
P4=10

Average waiting time=Waiting time of all processes / Number of processes

=(17+3+0+10) /4
=30/4
=7.5 milliseconds (ms)

Gantt Chart FCFS



Waiting Time
P1=0
P2=9
P3=16
P4=19

Average waiting time=Waiting time of all processes / Number of processes

=(0+9+16+19) /4
=44/4
=11 milli seconds (ms)

For each scheduling Gantt chart 1M,

Each average waiting time calculation 1M

e) **Describe free space management technique. (Any two)** **4M**

Ans. A file system is responsible to allocate the free blocks to the file therefore it has to keep track of all the free blocks present in the disk.There are mainly four approaches by using which, the free blocks in the disk are managed.

Any 2 techniques Correct Explanation 2M each

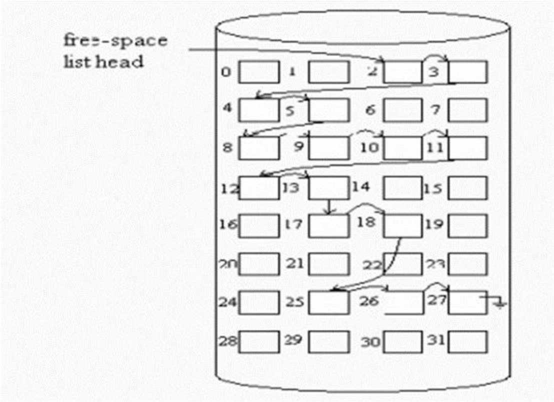
1. Bit Vector
2. Linked List

1)Bit Vector:
The free-space list is implemented as a bit map or bit vector.
Each block is represented by 1 bit. If the block is free, the bit is 1; if the block is allocated, the bit is 0.
For example, consider a disk where blocks 2, 3, 4, 5, 8, 9, 10, 11, 12, 13 are free and the rest of the blocks are allocated.
The free-space bit map would be : 0011110011111100

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	1	1	1	1	0	0	1	1	1	1	1	1	0	0

1=Free block
0= Allocated block
The main advantage of this approach is its relative simplicity and its efficiency in finding the first free block or n consecutive free blocks on the disk.

2) Linked List
In this approach, the free disk blocks are linked together i.e. a free block contains a pointer to the next free block. The block number of the very first disk block is stored at a separate location on disk and is also cached in memory. In this approach, link all the disk blocks together, keeping a pointer to the first free block. This block contains a pointer to the next free disk block, and so on.



5.		**Attempt any <u>TWO</u> of the following:**	**12**
	a)	**Write two uses of following O.S. tools** **(i) Device Management** **(ii) Performance monitor** **(iii) Task Scheduler**	**6M** ***2 uses of each tool 2M***
	Ans.	**i) Device management:** • Managing all the hardware or virtual devices of computer system. • Allow interaction with hardware devices through device driver. • Used to install device and component-level drivers as well as associated software. • Allocate devices to the process as per process requirement and priority. • Deallocate devices either temporarily or permanently depending on condition. • Keeping track of all device's data and location. • Monitoring device status like printers, storage drivers and other devices. • Used to enforce the predetermined policies and decides which process receives the device when and for how long. **ii) Performance monitor** 1. Monitor various activities on a computer such as CPU or memory usage. 2. Used to examine how programs running on their computer affect computer's performance 3. It is used to identify performance problems or bottleneck that affect operating system or installed applications. 4. Used to observe the effect of system configuration changes.	

iii) Task scheduler

1. Assign processor to task ready for execution
2. Executing predefined actions automatically whenever a certain set of condition is met.

(Any two relevant uses shall be considered)

b) **Writer the outputs of following commands** **6M**

(i) Wait 2385018
(ii) Sleep 09
(iii) PS –u Asha

Ans.

i) Wait command waits until the termination of specified process ID 2385018

ii) Sleep command is used to delay for 9 seconds during the execution of a processi.e. it will pause the terminal for 9 seconds.

iii) ps command with -u is used to display data/processes for the specific user Asha.

2M for each correct output

c) **Given a page reference string with three (03) page frames. Calculate the page faults with 'Optimal' and 'LRU' page replacement algorithm respectively.** **6M**

'7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1

Ans.

(Representation of frame can be in any order)

i) Optimal

Ref	7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
F1	7	7	7	2	2	2	2	2	2	2	2	2	2	2	2	2	2	7	7	7
F2		0	0	0	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0
F3			1	1	1	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1
Fault	F	F	F	F		F		F			F			F				F		

Total page faults- 9

ii) LRU

Ref	7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
F1	7	7	7	2	2	2	2	4	4	4	0	0	0	1	1	1	1	1	1	1
F2		0	0	0	0	0	0	0	0	3	3	3	3	3	3	0	0	0	0	0
F3			1	1	1	3	3	3	2	2	2	2	2	2	2	2	2	7	7	7
Fault	F	F	F	F		F		F	F	F	F			F		F		F		

Total page faults-12

Calculate page fault with relevant diagram-3M each

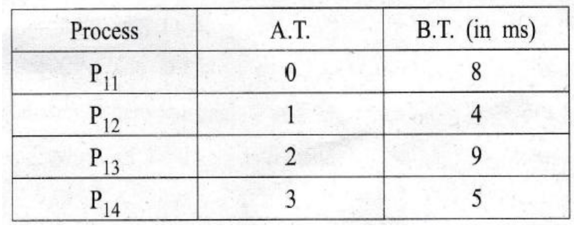
6. **Attempt any TWO of the following:** **12**

a) **Solve given problem by using** **6M**

(i) Pre-emptive SJF

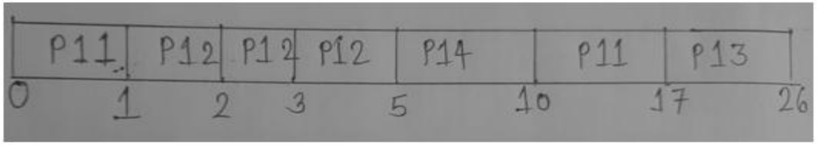
(ii) Round Robin (Time Slice = 3 ms)

Calculate average waiting time using Gantt Chart



Process	A.T.	B.T. (in ms)
P_{11}	0	8
P_{12}	1	4
P_{13}	2	9
P_{14}	3	5

Ans. **(i) Pre emptive SJF:**

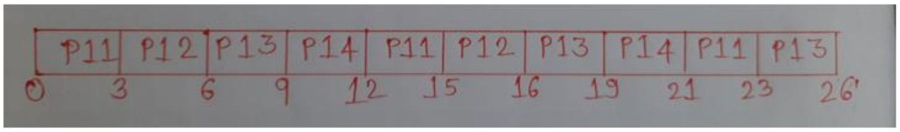


Each method 3M - 1M for Gantt chart, 1M for Waiting time calculation, 1M for Average waiting time

Waiting Time= (Total completion time –Burst time) – Arrival time

P11 –(17-8)-0 = 9ms,
P12- (5 – 4) -1 =0ms,
P13- (26-9)-2 =15ms,
P14- (10-5)-3 =2ms
Average waiting time :- (9+0+15+2)/4= 26/4=6.5 ms

(ii) Round Robin (Time Slice = 3 ms)



Waiting time: - P11 = (23-8)-0 =15ms,
P12-(16 – 4)- 1 =11ms,
P13-(26-9)-2 =15ms,
P14-(21-5)-3 =13ms
Average waiting time:- (15+11+15+13)/4=54/4= 13.5ms

<table>
<tr>
<td></td>
<td>b)

Ans.</td>
<td>
Consider the following memory map and assume a new process P4 comes with memory requirements of 6 KB.
Locate (Draw) this process in memory using.
i) First fit
ii) Best Fit
iii) Worst Fit
<table>
<tr><td>O.S.</td></tr>
<tr><td>P1</td></tr>
<tr><td><FREE> 12 KB</td></tr>
<tr><td>P2</td></tr>
<tr><td><FREE> 19 KB</td></tr>
<tr><td>P3</td></tr>
<tr><td><FREE> 7KB</td></tr>
</table>
Memory
<table>
<tr>
<td>First Fit: Allocate the first free block to the new process P4.
<table>
<tr><td>O. S.</td></tr>
<tr><td>P1</td></tr>
<tr><td>**P4 6KB**
<FREE> 6KB</td></tr>
<tr><td>P2</td></tr>
<tr><td><FREE> 19 KB</td></tr>
<tr><td>P3</td></tr>
<tr><td><FREE> 7 KB</td></tr>
</table>
</td>
<td>Best Fit: Allocate the smallest free block that is big enough to accommodate new process P4.
<table>
<tr><td>O. S.</td></tr>
<tr><td>P1</td></tr>
<tr><td><FREE> 12 KB</td></tr>
<tr><td>P2</td></tr>
<tr><td><FREE> 19 KB</td></tr>
<tr><td>P3</td></tr>
<tr><td>**P4 6 KB**
<FREE> 1 KB</td></tr>
</table>
</td>
<td>Worst fit: Allocate the largest free block to the new process P4.
<table>
<tr><td>O. S.</td></tr>
<tr><td>P1</td></tr>
<tr><td><FREE> 12 KB</td></tr>
<tr><td>P2</td></tr>
<tr><td>**P4 6 KB**
<FREE> 13 KB</td></tr>
<tr><td>P3</td></tr>
<tr><td><FREE> 7 KB</td></tr>
</table>
</td>
</tr>
</table>
</td>
<td>6M

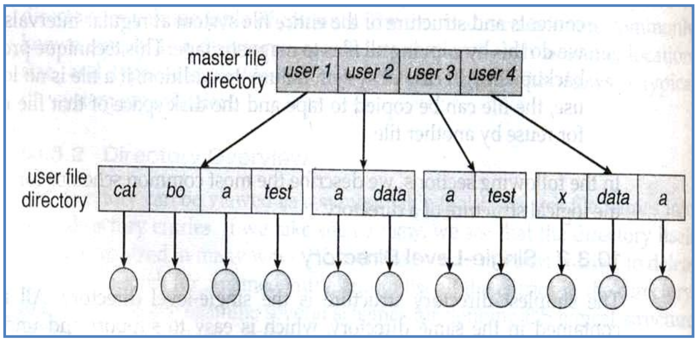
Each fit diagram 2M</td>
</tr>
<tr>
<td></td>
<td>c)

Ans.</td>
<td>
Construct and explain directory structure of a file system in terms of two level and tree structure.
1) **Two-level directory: -**
In the two-level structures, each user has its own user file directory (UFD). The UFD lists only files of a single user. System contains a master file directory (MFD) which is indexed by user name or account number. Each entry in MFD points to the UFD for that user.
When a user refers to a particular file, only his own UFD is searched. Different users can have files with the same name, as long as all the file names within each UFD are unique.
</td>
<td>6M

Explanation of structure 2M each,

Construction of structure 1M each</td>
</tr>
</table>

When we create a file for a user, operating system searches only that user's UFD to find whether same name file already present in the directory. For deleting a file again operating system checks the file name in the user' UFD only.



2. **Tree structure**:-

In this directory structure user can create their own sub-directories and organize their files. The tree has a root directory and every file has a unique path name. A directory contains a set of files or subdirectories. All directories have the same internal format. One bit in each directory entry defines the entry as a file (0) or as a subdirectory (1). Each process has a current directory. Current directory contains files that are currently required by the process. When reference is made to a file, the current directory is searched. If a file needed that is not in the current directory, then the user usually must either specify a path name or change the current directory.