OS
ESE
18|12|2021

Somaiya Vidyavihar University

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Q. No.: 1

1) a
2) b
3) c
4) a
5) e
6) d
7) d
8) a
9) c
10) c

Q. No.: 1 B

I) The shell is the operating system's command-line interface and interpreter for the set of commands that are used to communicate with the system.

- A shell script is a sequence of shell and operating system commands in a file.
- eg) $ Command Argument(s)

  → when you type a command and press enter, the shell evaluates the command and carries it out.

- It helps in file management, interactive debugging, I/O management, memory management, etc.

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III) The seven states of process are:-

(i) New : In this step, the process is about to be created but not yet created.

(ii) Ready : After the creation of process, the process is ready to run i.e. loaded into main memory.

(iii) Run : The process is chosen by CPU for execution

(iv) Blocked/wait : The process continues to wait in the main memory and does not require CPU but as the I/O operation is completed, it goes to the ready state.

(v) Terminated : The process is killed and PCB is deleted.

(vi) Suspend ready : The process that was in a ready state but was swapped out of main memory and placed into external storage are said to be in suspend ready state

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(vii) Suspend Wait/ Suspend block : Similar to suspend ready but uses the process which was performing I/O operation and lack of main memory caused them to move to secondary memory

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iv) The list of file system layers are :-

- Application programs
- Logical file system
- file organization module
- Basic file system
- I/O control.
- Devices

vi) A pipe is a connection between two processes such that the standard output from one process is the standard input of the other process.

- Pipe is one way communication only and can be used to create process as well as child processes for reading and writing.
- Pipe system call finds ~~to~~ two available positions in the process's open file table and allocates them for the read and write ends of pipe

eg) int pipe (int p[2])

0 on success

-1 on error

p[0] will be file descriptor for read end of pipe

p[1] will be file descriptor for write end of pipe

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vii) Virtual memory is a technique aiming to solve memory's physical shortages by using the secondary memory so that an OS considers it as a part of the main memory.

- The main advantages of virtual memory is that an OS can load programs larger than its physical memory.
- It also provides memory protection
- More processes may be maintained in the main memory and this process can be larger than all of the main memory.
- It also allows greater programming levels by using less of the available memory for each process.

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Q. No.: 2

(A)

The ~~original~~ arrival and burst time of the given processes are:-

Process	Burst time	Arrival time
P_0	11	1
P_1	9	6
P_2	7	7
P_3	12	4
P_4	14	3
P_5	5	2

Gantt chart:-

//////	P_0	P_5	P_4	P_3	P_1	P_2
0 – 1	1 – 12	12 – 17	17 – 31	31 – 43	43 – 52	52 – 59

The shaded box represents idle time

Turnaround time = Completion time − arrival time

Waiting time = Turnaround time − Burst time

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Process	Completion time	Turnaround time	waiting time
P_0	12	11	0
P_1	52	46	37
P_2	59	52	45
P_3	43	39	27
P_4	31	28	14
P_5	17	15	10

Avg turnaround time $= \frac{11+46+52+39+28+15}{6}$

$= \frac{191}{6}$

$= 31.83$ units

Avg waiting time $= \frac{0+37+45+27+14+10}{6}$

$= \frac{133}{6}$

$= 22.16$ units

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B

Process	Burst time	Arrival time
P_0	11	1
P_1	9	6
P_2	7	7
P_3	12	4
P_4	14	3
P_5	5	2

Gantt chart:

///	P_0	P_5	P_2	P_1	P_3	P_4
0 – 1	1 – 12	12 – 17	17 – 24	24 – 33	33 – 45	45 – 59

Turn around time = completion time − arrival time

Waiting time = Turnaround time − Burst time

Process	Completion time	Turnaround time	waiting time
P_0	12	12 − 1 = 11	11 − 11 = 0
P_1	33	33 − 6 = 27	27 − 9 = 18
P_2	24	24 − 7 = 17	17 − 7 = 10
P_3	45	45 − 4 = 41	41 − 12 = 29
P_4	59	59 − 3 = 56	56 − 14 = 42
P_5	17	17 − 2 = 15	15 − 5 = 10

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Avg turnaround time $= \frac{11 + 27 + 17 + 41 + 56 + 15}{6}$

$= \frac{167}{6}$

$= 27.83$ units

Avg waiting time $= \frac{0 + 18 + 10 + 29 + 42 + 10}{6}$

$= \frac{109}{6}$

$= 18.167$ units

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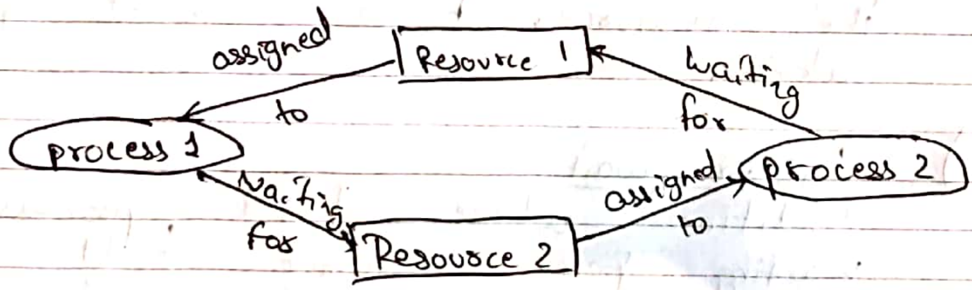
(A)

- Deadlock is a situation in which two computer programs sharing the same resources are effectively preventing each other from accessing the resource resulting in both programs ceasing to function.

- The set of processes are blocked because each process is holding a resource and waiting for another resource.

- eg) two trains are coming towards each other on same track and there exists only the track, none of the trains can move once they are in front of each other. This a deadlock situation.



- The necessary conditions for deadlock are :-

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i) Mutual exclusion
- A resource can be held by only one of the process at a time. The resources are non-shareable.

ii) Hold and wait
- Process can hold a number of resources at a time and at a same time, if is requestig for other resource which might be in use by another process so that causes hold and wait as it's waiting for that resource to be freed.

iii) No preemption
- A resource can't be taken from a process unless the process releases the resource, hence can not forcefully taken.

iv) Circular wait
- Condition where the first process is waiting for resource held by second process which in turn is waiting for third process which wants a resource from the first forming a circular wait ring.

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B

	Allocation			Max			Available			Need		
Process	A	B	C	A	B	C	A	B	C	A	B	C
P_0	1	1	2	4	3	3	2	1	0	3	2	1
P_1	2	1	2	3	2	2				1	1	0
P_2	4	0	1	9	0	2				5	0	1
P_3	0	2	0	7	5	3				7	3	3
P_4	1	1	2	1	1	2				0	0	0

I) We now need = Max − allocation

∴ using the formula above, the need matrix is :-

for P_0 = Max − allocation
= [4 3 3] − [1 1 2]
= [3 2 1]

P_1 = [3 2 2] − [2 1 2]
= [1 1 0]

P_2 = [9 0 2] − [4 0 1]
= [5 0 1]

P_3 = [7 5 3] − [0 2 0]
= [7 3 3]

P_4 = [1 1 2] − [1 1 2] = [0 0 0]

$\therefore$ Need matrix = $\begin{bmatrix} 3 & 2 & 1 \\ 1 & 1 & 0 \\ 5 & 0 & 1 \\ 7 & 3 & 3 \\ 0 & 0 & 0 \end{bmatrix}$

ii)

	Allocation			Max			Available			Need			
	A	B	C	A	B	C	A	B	C	A	B	C	
P_0	1	1	2	4	3	3	2	1	0	3	2	1	P_0 ✓
P_1	2	1	2	3	2	2	4	2	2	1	1	0	P_1 ✓
P_2	4	0	1	9	0	2	5	3	4	5	0	1	P_2
P_3	0	2	0	7	5	3	6	4	6	7	3	3	P_3
P_4	1	1	2	1	1	2	10	4	7	0	0	0	P_4 ✓

→ First we execute P_1

Sequence → P_1

→ Second we execute P_4 $\because$ only that is possible

sequence → $P_1 \rightarrow P_4$

→ Next we execute P_0

Sequence → $P_1 \rightarrow P_4 \rightarrow P_0$

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→ Next we execute P_2 and then P_3

Sequence → $P_1 \rightarrow P_4 \rightarrow P_0 \rightarrow P_2 \rightarrow P_3$

∴ the system is in a safe state all the process execute and their execution sequence is

$P_1 \rightarrow P_4 \rightarrow P_0 \rightarrow P_2 \rightarrow P_3$

(iii) After releasing the resources used by P_3, the total available resource comes out to be :-

	A	B	C
	10	4	7
+	0	2	0
	10	6	7

A has 10
B has 6 as total resources.
C has 7

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(A)

Paging in memory management in OS

i) Paging is a non-contiguous form of memory management

ii) The main memory is divided into frames whereas the processes are divided into pages

iii) The size of page and frame are same.

iv) In this a page of the process is loaded onto the main memory as a frame i.e. each page occupies a frame.

v) It allows for a higher degree of multiprogramming as some pages of the process need not be allocated in the main memory ∴ allowing more processes to be entered into the main memory hence increasing the degree of multiprogramming and CPU utilisation helping the faster access of data.

eg) the main memory of 16kb with 4 processes of 4 kb each. The frame size will be 1kb

Frame size = Page size = 1kb

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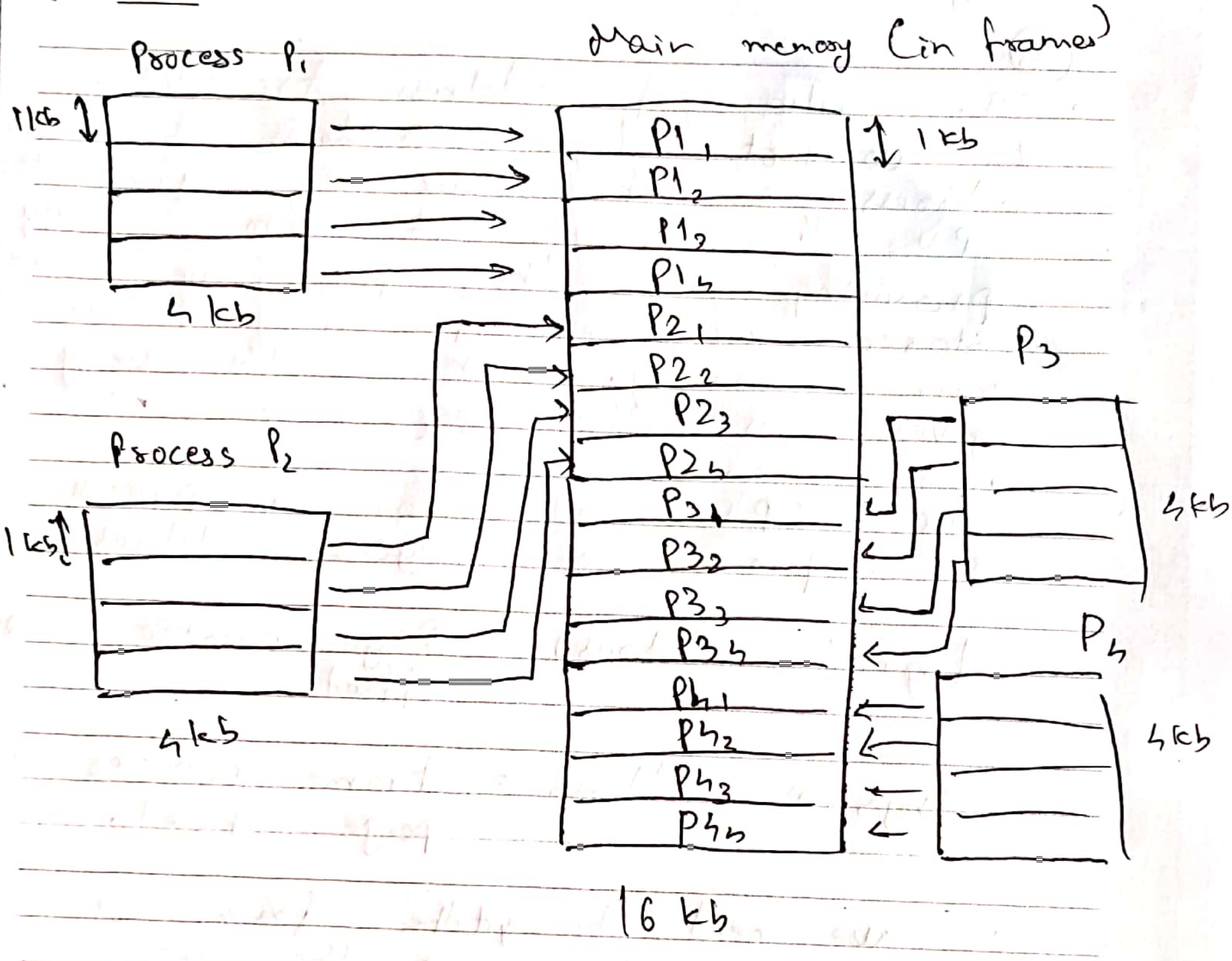

Hence we have allotted 4 processes having 4 pages each into the main memory having 16 frames.

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(B)

- The idea of address translation is to convert logical address to physical address so that we can give the CPU the process it demands by providing it the page we have stored in our frames in the main memory. The CPU only gives us the page, we need to find frame.
- The CPU asks for a process in the form of logical address

Logical address = Page number + page offset

Physical address = Frame number + page offset.

∴ we need to get the frame where the page is store in the main memory.

- The CPU provides us with a logical address containg page number, we will then need to find this particular page in our main memory.
- This is done via the use of page map table which contains the page number with its allocated frame.

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The page map table is also used in the main memory. Once we get the physical address, we can go to that frame in the memory, translate to the offset in the frame and provide the CPU with that information which is selected.