① (a) Defn: Set of computers interconnected together to solve larger task is called a distributed system. O/S used in these system is called distributed O/S.

(b)

Process	at	next CPU t.l	w.t	CPU time
a	1	3	0	1+3+1+1
b	2	2		
c	3	1	1	
d.	4	1	1	

Order of exec^n

a c d. → w.t = 1

or

a d c → w.t = 0

Ans:- 1 or 0.

(c) boolean fetch-and-set(boolean S). (or Semaphore)

core-1

return old value of S and set S to 1. i.e S=1

or

core-2

return old value of S and set S to 0. i.e S=0

(d) i) time sharing O/S

ii) Priority scheduling (Real time O/S)

(e) $t_{av} = H t + (1-H) t_p$; $t = 10$ sec $t_p = 10^{-2}$ sec

$= 99.99 \times 10^{-6} + 0.01 \times 10^{-2}$ $H = 99.99\%$.

$= 10^{-4} + 10^{-4}$

$= 2 \times 10^{-1} \times 10^{-3}$

$= 0.2$ millisecond. Ans.

(f). best case; 0

worst case: page size

average = $\frac{\text{best} + \text{worst}}{2}$

$= \frac{0 + \text{page size}}{2}$

$= \frac{1}{2} \times$ Page size.

(g).

1	2	3	4	1	2	3	5	1	2	3
f	f	f	f	h	h	f	f	h	h	f
1	1	1	1			1	1			
	2	2	2			2	2			
		3	4			3	5			

page fault = 7.

(h) first fit $\leq$ worst fit $<$ best fit

$O(n)$ $\quad \Theta(n)$ $\quad \Theta(n \log n)$

(i)

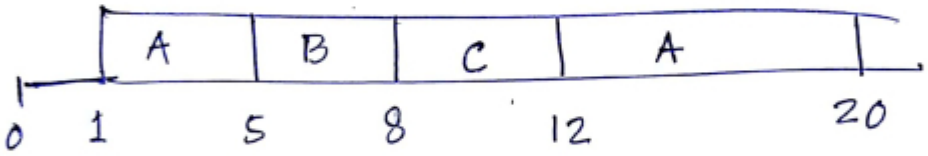
1. Time sharing.
2. Priority

(ii) (c) Scheduling process

2.(a)(i) RR

Process	at	bt	wt	CPU time
A	1/5	12/8/0	0+7	1+4+3 +4+8
B	2	3/0	3	
C	3	4/0	5	

Gantt chart. order of execution



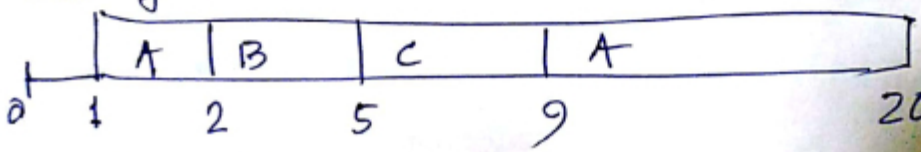
Response time A=0, B=3, C=5

Wait. time A=7 B=3 C=5

(ii)

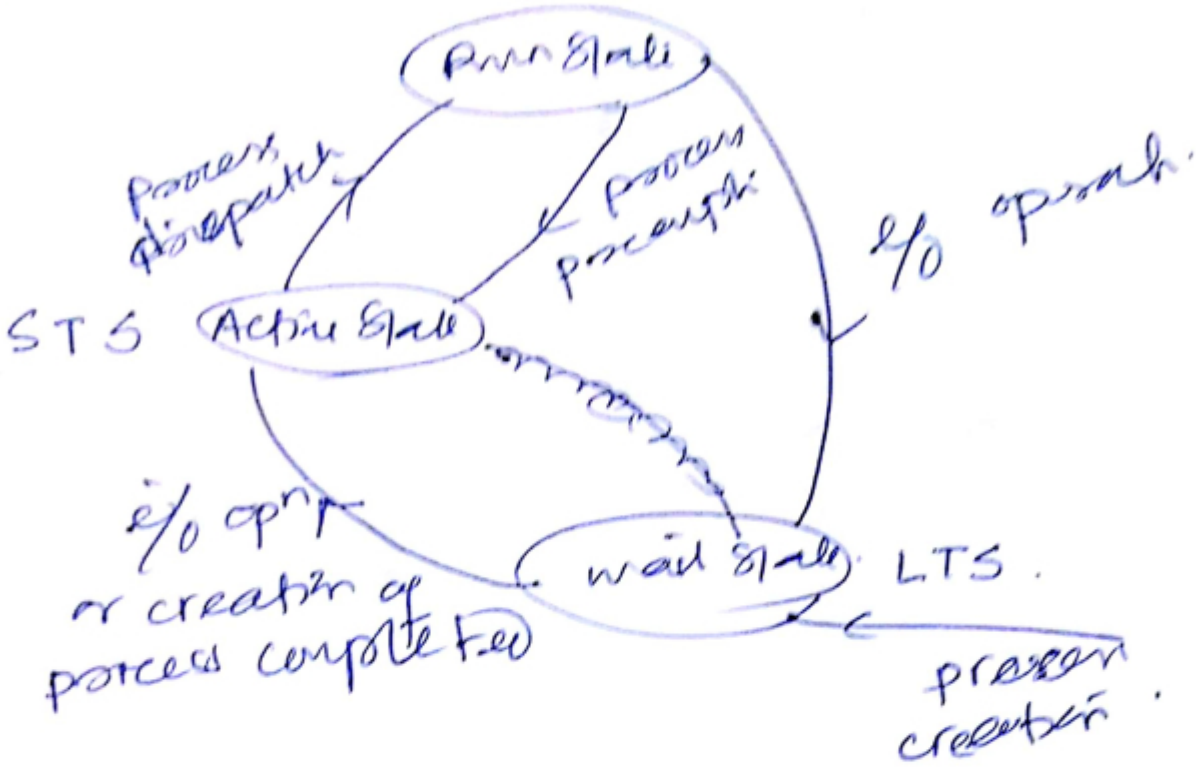
Process	at	bt	wt.	CPU time
A	1/2	12/10	0+7	1+1+3+4
B	2	3/0	0	
C	3	4/0	2	

order of execution



Response time = A=0, B=0, C=2, wait time A=7, B=0, C=2

2-(b)



description :

Q3) (a) semaphore definition with wait and signal operations. -2 marks.

Structure implementation -2marks

(b) Satisfies - mutual exclusion
- Bounded waiting
- explanation
] -2mark

may lead to deadlock in case both the processes set their flags that is P1-flag and P2-flag to true.

Both processes will wait for even and Progress is not satisfied. -2mark.

Q4)

max	Allocation	Need
A → 8 4 3	0 0 1	8 4 2
B → 6 2 0	3 2 0	3 0 0
C → 3 3 3	2 1 1	1 2 2

Available = 3, 2, 2

(a) Let work = 3, 2, 2

Process B can complete

Updated work = 3, 2, 2 + 3, 2, 0 = 6, 4, 2

Now process C can complete

Updated work = 6, 4, 2 + 2, 1, 1 = 8, 5, 3

Process A can now complete, hence System is safe

(B, C, A) is a safe sequence
Any other safe sequence can be verified and awarded with mark — 4 marks.

(b) $Request_B = 2,0,0 \leq Need_B$ (which is 3,0,0)

So valid request

Request B also < Available (which is 3,2,2)

Resulting state change is as follows.

	Allocation	Need		
		8	4	2
A –	0, 0, 1	1	0	0
B –	5, 2, 0	1	2	2
C –	2, 1, 1			

Available = 1, 2, 2

Work = 1, 2, 2,

Process B can complete

Updated work = 1, 2, 2 + 5, 2, 0 = 6, 4, 0

Process C can complete

Updated work = 6, 4, 0 + 2, 1, 1 = 8, 5, 1

Process A can complete

Hence resulting state will be safe and the request will be granted

– 4 marks.

Q5) (a) Contigens allocatim — Static Pantitim
- Demerits: internal fragmentatin
- Dynamic Ivariable Pantims
- External fragmentatin

Non-contigens allocatim - paging
- internal fragmentatin
- Segmentatim
- external fragmentatin

Marks to be awarded by looking into the relevant contents in the answer — 4 marks.

(b) (i) logical addren = | P | d |

P = 32 Pages = 2^5 → 5 bits.

d = 1024 word = 2^{10} → 10 bits.

logical addren = 5+10 = 15 bits.

(ii) Physical memory = $32 \times 1024 = 2^5 \times 2^{10} = 2^{15}$

Physical addren = 15 bits

— 4 marks.

26) (a) - Handware support includes how the Page table is stored and accened.

Marks to be awarded by considering the HW support for storing and accessing the page table.

— 4 marks.

(b) Explanation of the operations — 4 marks.

2 marks for each operation.

Q7) (a) file allocation methods like

- Contigency
- linked
- Indexed

marks to be awarded by looking into the explanation and relative advantages and disadvantages

— 4 marks.

(b) Domain of protection — 2 marks.

Access matrix with example. — 2 marks.

Q8) (a) Resource Allocation Graph

* Explanation of ~~vertices~~ vertex type & edge types — 2 marks.

* Use of RAG — 2 marks.

(b) I/O management.

* I/O operations carried out with O.S., device drivers & device controllers — 4 marks.