Q. (1)

TD. Soln. (OSSP)

Given:

P.A.S = 36 bit

P.A.S = 2^{36} B

page size = 8 KB = 2^{13} B

P.T.E = | frame no. | Valid/Invalid | Ref. no | R/W |

1 bit 1 bit 1 bit

(i) Length of Virtual/Logical Address Space (in B) = ?

Given:

Max. size of P.T = 32 GB

= $2^5 \times 2^{30}$ B

= 2^{35} B

3 Marks

Logical Address

| p | d |

bits used to represent # pages in page Table

bits used to represent size of page.

d = 13 bits

as page size is given = 2^{13} B

Entries / # pages in page table

$= \frac{P.T.S}{P.T.E.S} = \frac{2^{35}\ B}{P.T.E.S}$

$= \frac{2^{35}\ B}{\#\text{bits for frames} + 3\text{ bits}} = \frac{2^{35}\ B}{23 + 3\text{ b}}$

$= \frac{2^{35}\ B}{26\text{ bits}} = \frac{2^{35}}{2^3}\ B$

Entries in P.T = 2^{32}

bits used to represent pt = 32 bits

frames = $\frac{P.A.S}{\text{frame size}}$

$= \frac{2^{36}\ B}{2^{13}\ B} = 2^{23}$

= 23 bits represents the frame.

$P = 33$ bits

$L.A = 33 + 13 = 46$ bits

$L.A.S = 2^{46}$ B Ans.

$\frac{2^{35}\text{ B}}{26\text{ bits}} = 2^{30}$

$= \frac{2^{30}}{2^5}$

$\equiv 2^5$

(ii) $T.L.B\ A.T = 20 \times 10^{-9}$ sec.

$m.m.A.T = 100 \times 10^{-9}$ sec.

$T.L.B\ H.R = 95\%$.

2 Marks

$E.m.A.T = \frac{95}{100} \times (T.L.B.A.T + m.m.A.T)$

$+ \frac{5}{100}(T.L.B.A.T + 2 \times m.m.A.T)$

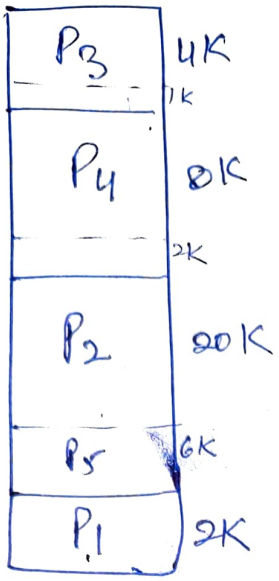
$= \frac{95}{100} \times \left[(20 + 100) \times 10^{-9}\right] + \frac{5}{100}\left[220 \times 10^{-9}\right]$

$= .95(120 \times 10^{-9}) + .05 \times (220 \times 10^{-9})$

$= 10^{-9}(114 + 11)$

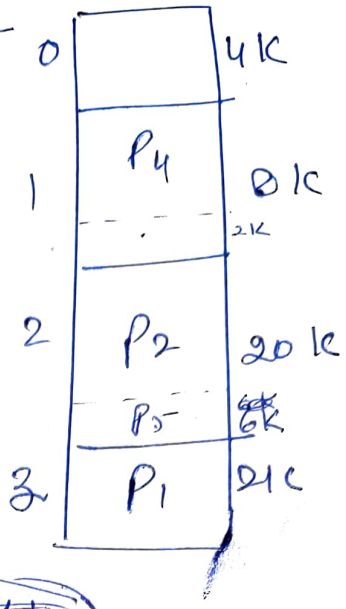
$E.m.A.T =$ 125 nano seconds.

Q.2



If variable partitioning is considered.

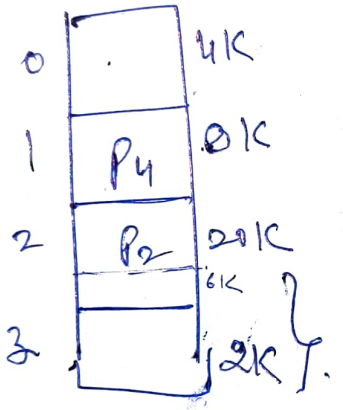
at T=2



P5 - 6K

P6, P7, P8

at T=4.



P6, P7, P8
10K 7K 20K

P7 gets in at T=4 and runs for 8 unit of Time so it get completed at T=12 Ans.

3 Marks for correct ans.
else 0.5

If fixed partitioning is considered — T = 19 Ans.

P7 will get chance at T=11

(i) Need Matrix

	X	Y	Z	W
P0	1	1	1	1
P1	1	1	2	1
P2	1	1	1	1
P3	1	1	1	0
P4	2	2	1	1

Need = Max − Allocated

0.5 for Need Matrix

Total Available
X = 5
Y = 6
Z = 7
W = 6

(ii) System is safe → if (Total Available = X = 5, Y = 6, Z = 7, W = 6)

current Available = Total − Allocated

$X_{Cur.Avail} \Rightarrow X_{Total} - X_{Allo} = 5 - 4 = 1$

$Y_{cur.Avail} \Rightarrow Y_{Total} - Y_{Allo} = 6 - 5 = 1$

$Z_{cur.Avail} \Rightarrow Z_{Total} - Z_{Allo} = 7 - 5 = 2$

$W_{cur.Avail} \Rightarrow W_{Total} - W_{Allo} = 6 - 5 = 1$

2 marks for safe sequence

Current Available:

X	Y	Z	W
1	1	2	1

→ Order of processes.

① P_0 P_1 P_2 P_3 P_4

P_0 → P_1 P_2 P_3 P_4

any order is correct except starting from P_4 ✓ ✓

In case:

Total Available = X = 3, Y = 6, Z = 4, W = 3

current Available

X	Y	Z	W
−1	1	−1	−2

Allocated > Total which is not possible

→ Hence, quest can't be solv. and deadlock can not be resolved.

(iii) yes.

P_3 → $P_0\ P_1\ P_2\ P_4$

for any order.

1.5 marks for correct ans. with explanation

Q. Given:- 3 concurrently executing threads within the same process

- using 2 semaphores S1, S2
- S1 = 1 , S2 = 0
- Global variable ⇒ y = 5

① Th A

1. P(&S2);
2. P(&S1);
3. y = y+4;
4. V(&S1);

② Th B

1. P(&S1);
2. y = y-2;
3. V(&S1);

③ Th C

1. P(&S1);
2. y = y*3;
3. V(&S2);
4. V(&S1);

Soln:- Slip:1 Th B or Th C both can start execution

Case: ① Th B

S1 = 1 0 1 0 1
S2 = 0 1
y = 5 3 9 13

1. ✓
2. y = 5-2 = 3
3. ✓

↓ Th C

1. ✓
2. y = 3*3 = 9
3. ✓
4. ✓

↓ Th A

1. ✓
2. ✓
3. y = 9+4 = 13
4. ✓

y = 13

1 marks

Case ② Th C

1. ✓
2. y = 5*3 = 15
3. ✓
4. ✓

↓ Th A

1. ✓
2. ✓
3. y = 15+4 = 19
4. ✓

↓ Th B

1. ✓
2. y = 19-2 = 17
3. ✓

y = 17

↓ Th B

1. ✓
2. y = 15-2 = 13
3. ✓

↓ Th A

1. ✓
2. ✓
3. y = 13+4 = 17
4. ✓

y = 17

1.5 marks

0.5 mark for semaphore Role

Ans.

Q5

Z=240

Z=240

(ii)

$S_1 = 0$ $S_2 = 1$ $S_3 = 0$

P(4S1) P(4S2) P(4S3)

opt P(4S2)

Z = Z+30 Z = Z-40 Z = Z+20

V(S3) V(S2)

opt V(4S2) V(S1) V(S3)

2.5 marks

(i) Min = 160 max. 250

2.5 marks

BA = 90