# CS3000 - Operating systems

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## Question 1:

### Step-1

⇒ According to the web portal / present roll list.

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⇒ Brust time:-

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↳ ASCII values corresponding to above letters.

71, 85, 82, 82, 65, 77, 72, 69, 77, 65

⇒ After subtracting each value with minus 60.

BT:- 11, 25, 22, 22, 5, 17, 12, 9, 17, 5

| Pid | $P_1$ | $P_2$ | $P_3$ | $P_4$ | $P_5$ | $P_6$ | $P_7$ | $P_8$ | $P_9$ | $P_{10}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| AT | 0 | 2 | 4 | 5 | 7 | 7 | 12 | 14 | 14 | 17 |
| BT | 11 | 25 | 22 | 22 | 5 | 17 | 12 | 9 | 17 | 5 |

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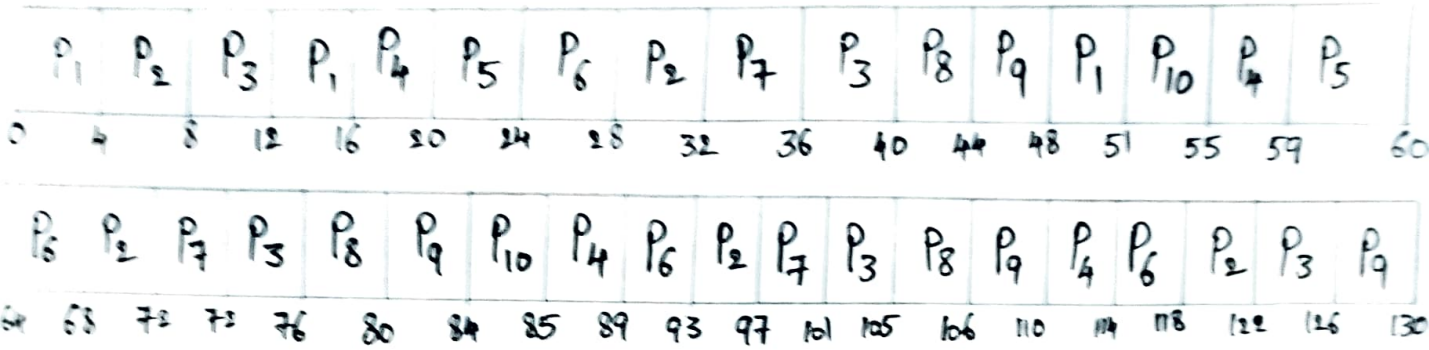
⇒ Gantt chart




| Job/ Pid | A·T | B·T | F·T | T·A·T | W.T | R·T |
|---|---|---|---|---|---|---|
| $P_1$ | 0 | 11 | 51 | 51 | 40 | 0 |
| $P_2$ | 2 | 25 | 145 | 143 | 118 | 2 |
| $P_3$ | 4 | 22 | 141 | 137 | 115 | 4 |
| $P_4$ | 5 | 22 | 144 | 139 | 117 | 11 |
| $P_5$ | 7 | 5 | 60 | 53 | 48 | 13 |
| $P_6$ | 7 | 17 | 135 | 128 | 111 | 17 |
| $P_7$ | 12 | 12 | 101 | 89 | 77 | 20 |
| $P_8$ | 14 | 9 | 106 | 92 | 83 | 26 |
| $P_9$ | 14 | 17 | 142 | 128 | 111 | 30 |
| $P_{10}$ | 17 | 5 | 85 | 68 | 63 | 34 |

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⇒ Average completion Time = 1110/10 = 111

⇒ Average Turn Around Time = 1028/10 = 102.8

⇒ Average waiting Time = 883/10 = 88.3

⇒ Average Response Time = 157/10 = 15.7

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## Question-2

⇒ Calculation of "MAX" Matrix.

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↳ ASCII values corresponding to above letters.

71, 85, 82, 82, 65, 77, 72, 69, 77, 65, 78, 84

✳ MAX Matrix :-

| Pid | A | B | C |
|---|---|---|---|
| $P_0$ | 11 | 25 | 22 |
| $P_1$ | 22 | 5 | 17 |
| $P_2$ | 12 | 9 | 17 |
| $P_3$ | 5 | 18 | 24 |

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@ matrix Need

| Pid | A | B | C |
|---|---|---|---|
| $P_0$ | 8 | 20 | 18 |
| $P_1$ | 18 | 2 | 14 |
| $P_2$ | 9 | 5 | 14 |
| $P_3$ | 0 | 14 | 19 |

- Operations :- calculating the Need Matrix....

Need [n][n] = Max[n][n] - Allocation[n][n]

Need [0] [0] = 11-3 = 8 Need[0][1] = 25 - 5 = 20 Need[0][2] = 22-4 = 18

Need [1] [0] = 22-4=18 Need [1] [1] = 5-3 = 2 Need [1] [2] = 17-3 = 14

Need [2][0] = 12-3=9 Need [2][1] = 9-4 = 5 Need [2] [2] = 17-3 = 14

Need [3] [0] = 5-5 = 0 Need [3][1] = 18-4 = 14 Need [3] [2] = 24-5 = 19

Need [4] [0] = 0-0 = 0 Need [4][1] = 0-0 = 0 Need [4] [2] = 0-0 = 0

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⑥ Initial Value of Resources

A=35, B=35, C=35

Total Allocated Resources

A=15, B=16, C=15

Available Resources,

A=20, B=19, C=20

Operations:- calculating the Final order.....

Step 1:- Available Matrix = 20, 19, 20 AS Need [1] = (18, 2, 14) < Available = (20, 19, 20) ⇒ process $P_1$ is selected.

→ New Available Matrix is (20, 19, 20) + (4, 3, 3)

= (24, 22, 23)

Step 2:- Available Matrix = 24, 22, 23

AS Need [3] = (9, 5, 14) < Available = (24, 22, 23)

⇒ process p2 is selected.

→ New Available Matrix is (24, 22, 23) + (3, 4, 3)

= (27, 26, 26)

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Step 3:- Available Matrix = 27, 26, 26

As Need[3] = (0, 14, 19) < Available = (27, 26, 26)

⇒process $P_3$ is selected.

→New Available Matrix is (27, 26, 26) + (5, 4, 5)

= (32, 30, 31)

Step 4:- Available Matrix = 32, 30, 31

As Need[0] = (8, 20, 18) < Available = (32, 30, 31)

⇒process $P_0$ is selected

→New Available Matrix is (32, 30, 31) + (3, 5, 4)

= (35, 35, 35)

∴ The sequence is safe

∴ Safe sequence : $P_1$ $P_2$ $P_3$ $P_0$

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(c) request from $P_1 = (0, 2, 2)$

→ check if request $(P_1) <= Need(P_1)$

$(0, 2, 2) <= (18, 2, 14)$

→ TRUE,

→ check if request $(P_1) <= Available$

$(0, 2, 2) <= (20, 19, 20)$

→ TRUE,,

→ Now,

(i) Available = Available − Request $(P_1)$

$= (20, 19, 20) - (0, 2, 2)$

Available $= (20, 17, 18)$

(ii) Allocation $(P_1)$ = Allocation $(P_1)$ + Request $(P_1)$

$= (4, 3, 3) + (0, 2, 2)$

Allocation $(P_1) = (4, 5, 5)$

(iii) Need $(P_1)$ = Need $(P_1)$ − Request $(P_1)$

$= (18, 2, 14) - (0, 2, 2)$

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Need ($P_1$) = (18, 0, 12)

⇒ Updated Need Matrix :

| | A | B | C |
|---|---|---|---|
| $P_0$ | 8 | 20 | 18 |
| $P_1$ | 18 | 0 | 12 |
| $P_2$ | 9 | 5 | 14 |
| $P_3$ | 0 | 14 | 19 |

⇒ Operations : calculating the Final order...

Step 1 :- Available Matrix = 20, 17, 18

AS Need[1] = (18, 0, 12) < Available = (20, 17, 18)

⇒ process $P_1$ is selected.

→ New Available Matrix is (20, 17, 18) + (4, 5, 5) = (24, 22, 23)

Step 2 : Available Matrix = 24, 22, 23

AS Need[2] = (9, 5, 14) < Available = (24, 22, 23)

⇒ process $P_2$ is selected

→ New Available Matrix is (24, 22, 23) + (3, 4, 3) = (27, 26, 26)

Step 3 : Available Matrix = 27, 26, 26

AS Need[3] = (0, 14, 19) < Available = (27, 26, 26)

⇒ process $P_3$ is selected.

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→New Available matrix is (27, 26, 26) + (5, 4, 5)

= (32, 30, 31)

Step 4:- Available matrix = 32, 30, 31

AS Need [0] = (8, 20, 18) < Available = (32, 30, 31)

⇒process $P_0$ is selected

→New Available matrix is (32, 30, 31) + (3, 5, 4)

= (35, 35, 35)

⇒Updated Allocation:-

| Pid | A | B | C |
|---|---|---|---|
| $P_0$ | 3 | 5 | 4 |
| $P_1$ | 4 | 5 | 5 |
| $P_2$ | 3 | 4 | 3 |
| $P_3$ | 5 | 4 | 5 |

⇒ the Available resources are

(A, B, C) = (20, 17, 18)

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(d)

Request from $P_2 = (3,0,3)$

→check if request $(P_2) <= Need(P_2)$

$(3,0,3) <= (9,5,14)$

→"TRUE"

→Now check if request $(P_2) <= Available$

$(3,0,3) <= (20,17,18)$

→TRUE

(i) Available = Available - Request($P_2$)

$= (20,17,18) - (3,0,3)$

Available $= (17,17,15)$

(ii) Allocation($P_2$) = Allocation $(P_2)$ + Request($P_2$)

$= (3,4,3) + (3,0,3)$

Allocation $(P_2) = (6,4,6)$

(iii) Need $(P_2)$ = Need $(P_2)$ - Request $(P_2)$

$= (9,5,14) - (3,0,3)$

$= (6,5,11)$

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⇒Updated Need Matrix

| Pid | A | B | C |
|---|---|---|---|
| $P_0$ | 8 | 20 | 18 |
| $P_1$ | 18 | 0 | 12 |
| $P_2$ | 6 | 5 | 11 |
| $P_3$ | 0 | 14 | 19 |

Operations:- calculating the Need Matrix.....

Need[n][n] = Max[n][n] - Allocation[n][n]

Need[0][0] = 11-3 = 8  Need[0][1] = 25-5 = 20  Need[0][2] = 22-4 = 18

Need[1][0] = 22-4 = 18  Need[1][1] = 5-5 = 0  Need[1][2] = 17-5 = 12

Need[2][0] = 12-6 = 6  Need[2][1] = 9-4 = 5  Need[2][2] = 17-6 = 11

Need[3][0] = 5-5 = 0  Need[3][1] = 18-4 = 14  Need[3][2] = 24-5 = 19

Operations:- calculating the Final order...

Step 1:- Available Matrix = 17, 17, 15

As Need[2] = (6,5,11) < Available = (17,17,15)

⇒process $P_2$ is selected.

→New Available matrix is (17,17,15) + (6,4,6) = (23, 21, 21)

Step 2:- Available Matrix = 23, 21, 21

As Need[3] = (0, 14, 19) < Available = (23, 21, 21)

⇒process $P_3$ is selected.

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→New Available Matrix is (23,21,21)+(5,4,5)
= (28, 25, 26)

Step3:- Available Matrix = 28, 25, 26
As Need [0] = (8, 20, 18) < (28, 25, 26)
⇒process $P_0$ is selected.
→New Available Matrix is (28, 25, 26)+(3, 5, 4)
= (31, 30, 30)

Step4:- Available Matrix = 31, 30, 30
As Need[1] = (18, 0, 12) < (31, 30, 30)
⇒process $P_1$ is selected
→New Available Matrix is (31, 30, 30)+(4, 5, 5)
= (35, 35, 35)

✱ Updated Allocation:-

| P:id | A | B | C |
|---|---|---|---|
| $P_0$ | 3 | 5 | 4 |
| $P_1$ | 4 | 5 | 5 |
| $P_2$ | 6 | 4 | 6 |
| $P_3$ | 5 | 4 | 5 |

Available:-
(A, B, C) = (17, 17, 15)