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Question 1

Consider a uniprocessor system, where three processes (Process ID 1, 2, 3 respectively) are there. Arrival time of the three processes are last 3 digits of your registration number (i.e. if your registration number is 2013001001100l9, arrival time of P1=0, P2=1, P3=9). Burst time of process 1 is the addition of date (dd, i.e. if 21/07/2003 is Date of Birth, then it is 2+1 = 3), process 2 is addition of month (mm, if July then 0+7, i.e. 7), and process 3 is addition of last two digit of the year (yy, if 2003 then 0+3, i.e. 3, if it is 2000 then take first 2 digit). Assume that CPU is using Shortest remaining time first algorithm.

i. Calculate Waiting time of each of the process.
ii. Calculate turnaround time of each of the process.
iii. Calculate the percentage of time CPU remains idle.

Solution

Process	Arrival Time	Burst Time
P1	0	3
P2	4	1
P3	5	2

➔ **How Arrival Time for processes are obtained ?**

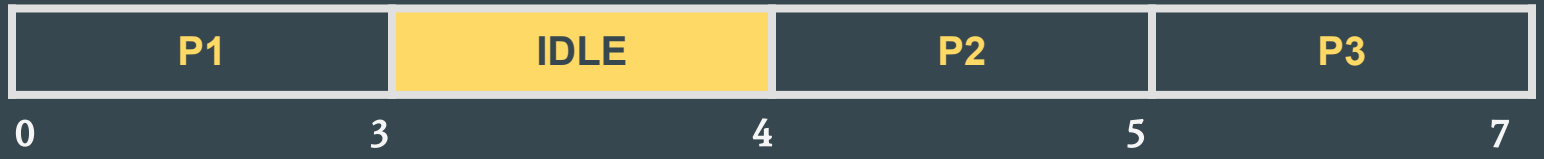
- My registration number is *211300100110045* and the last three digits of it are 0, 4, 5. Therefore, the arrival time for P1 is 0 , P2 is 4 and P3 is 5.

➔ **How Burst time for processes are obtained ?**

- My birth date is 21/10/2002. Therefore,
- The burst time for P1 is 3 (sum of digits in dd i.e. 2+1=3).
- The burst time for P2 is 1 (sum of digits in mm i.e 1+0=1).
- The burst time for P3 is 2 (sum of last 2 digits in yyyy i.e 0+2=2)

Algorithm for scheduling : Shortest remaining time first algorithm

GANTT Chart for the problem :



➔ **How the Gantt Chart is obtained ?**

- P1 arrives at 0. Since the **Burst time for P1 is 3** and **Arrival Time for P2 is 4**, P1 operates till **3 unit time.**
- The CPU remains ***idle*** for 1 unit time from 3 to 4 unit time.
- The process P2 arrives at 4. Since the **Burst time for P2 is 1** the process completes at **5 unit time**.
- The process P3 arrives at 5. Since the **Burst time for P3 is 2** , the process completes at **7 unit time.**

Calculations

➔ **Waiting time for each of the process:**

Waiting time (W.T.) = Completion Time - Arrival Time - Burst Time

Therefore,

- W.T. for P1 = **3 - 0 - 3 = 0** units of time
- W.T. for P2 = **5 - 4 - 1 = 0** units of time
- W.T. for P3 = **7 - 5 - 2 = 0** units of time

➔ **Turnaround time of each of the process**

Turnaround Time (T.A.T.)= Completion Time - Arrival Time

- T.A.T. for P1 = **3 - 0 = 3** units of time
- T.A.T. for P2 = **5 - 4 = 1** units of time
- T.A.T. for P3 = **7 - 5 = 2** units of time

➔ **Percentage of time CPU remains idle.**

CPU remains idle for 1 unit of time. Therefore, percentage of time CPU remains idle

= [(Idle time units) / (Total time units for completion of all processes)] * 100 %

= [(1 / 7) * 100 %] = **14.29 %**

Question 2

Consider a uniprocessor system, where there exist three processes (Process ID 1, 2, 3 respectively). CPU assigns priority of the processes based on highest waiting time of the processes present at that time after every 2-unit time. In any process terminates before the interval time then the default situation will be FCFS scheduling. Each of the process will arrive based on the last 3 digits of your university roll number. (If Roll No. is 13000118137, arrival time of P0 =1, P1=3, P2=7). CPU Burst time will be first three digits of your mobile number (i.e. if your mobile number is 8756540439, CPU burst time of P1=8, P2=7, P3=5, if any number is 0, then take next non zero value from your mobile number like 7000312867, CPU burst time of P1=7, P2=3, P3=1).

i. Calculate Average Waiting Time.
ii. Calculate Average Turnaround Time.
iii. Calculate the percentage of time CPU remains idle.

Solution

Process	Arrival Time	Burst Time
P1	0	9
P2	5	3
P3	8	3

➔ **How Arrival Time for processes are obtained ?**

- My university roll number is *13000121058* and the last three digits of it are 0, 5, 8. Therefore, the arrival time for P1 is 0 , P2 is 5 and P3 is 8.

➔ **How Burst time for processes are obtained ?**

- My mobile number is 9330450430 and the first three digits are 9, 3, 3. Therefore,
  - ➔ The burst time for P1 is 9.
  - ➔ The burst time for P2 is 3.
  - ➔ The burst time for P3 is 3.

➔ **Time quantum (T.Q.) is 2 units of time**

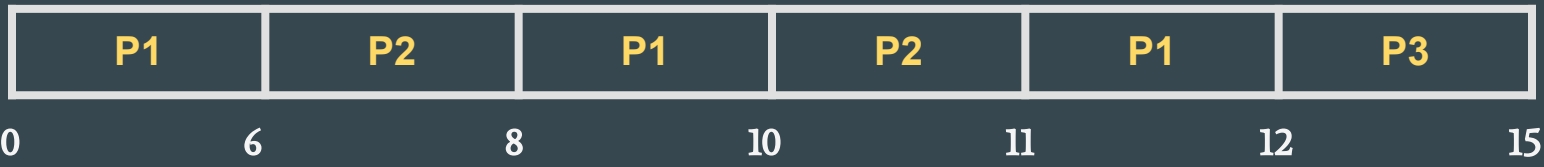
Algorithm :

➔ Priority of processes based on highest waiting time of the processes present at that time after every 2-unit time.

➔ FCFS (First Come First Serve) Scheduling if any process ends before the interval of 2 unit time

GANTT Chart for the problem

Resultant GANTT chart



➔ How the GANTT chart is obtained ?

- At 0 unit time , process P1 arrives.
- At 2 unit time , process P1 continues as no other process arrive.
- At 4 unit time , process P1 continues as no other process arrive.

Waiting time for process Px after n unit time = n - (arrival time of Px) - (Time units Px was executed)

- At 6 unit time :

  Waiting time for P1 = 6 - 0 - 6 = 0 unit of time.
  Waiting time for P2 = 6 - 5 - 0 = 1 unit of time. (highest waiting time)
  Therefore **P2** gets the CPU from **6 unit time to 8 unit time**.

- At 8 unit time :

  Process P3 arrives.
  Waiting time for P1 = 8 - 0 - 6 = 2 units of time. (highest waiting time)
  Waiting time for P2 = 8 - 5 - 2 = 1 unit of time.
  Waiting time for P3 = 8 - 8 - 0 = 0 unit of time
  Therefore **P1** gets the CPU from **8 unit time to 10 unit time**.

➔ How the GANTT chart is obtained ? (continued)

- At 10 unit time :

  Waiting time for P1 = 10 - 0 - 8 = 2 units of time.
  Waiting time for P2 = 10 - 5 - 2 = 3 units of time. (highest waiting time)
  Waiting time for P3 = 10 - 8 - 0 = 2 units of time
  Therefore **P2** gets the CPU from **10 unit time to 12 unit time**.
  P2 completes at **11 unit time.**

- At 11 unit time :

  P2 completes **before 12 unit time** and **FCFS (First Come First Serve) Scheduling** is followed for giving the CPU to the next process. Since **P1 arrived before P3**, **P1** gets the CPU from **11 unit time to 12 unit time**. **P1 completes at 12 unit time.**

- At 12 unit time :

  As **P3** is only remaining, P3 gets the CPU and completes at **15 unit time.**

Calculations

➔ **Waiting time for each of the process:**

Waiting time (W.T.) = Completion Time - Arrival Time - Burst Time

Therefore,

- W.T. for P1 = **12 - 0 - 9 = 3** units of time
- W.T. for P2 = **11 - 5 - 3 = 3** units of time
- W.T. for P3 = **15 - 8 - 3 = 4** units of time

Average Waiting Time (A.W.T.) = [(W.T. of P1) + (W.T. of P2) + (W.T. of P3)] / 3

Therefore A.W.T = (3 + 3 + 4) / 3 = 3.33 units of time

➔ **Turnaround time of each of the process**

Turnaround Time (T.A.T.)= Completion Time - Arrival Time

- T.A.T. for P1 = **12 - 0 = 12** units of time
- T.A.T. for P2 = **11 - 5 = 6** units of time
- T.A.T. for P3 = **15 - 8 = 7** units of time

Average Turnaround Time (A.T.A.T) = [(TAT of P1) + (TAT of P2) + (TAT of P3)] / 3

Therefore ATAT = (12 + 6 + 7) / 3 = 8.33 units of time

➔ **Percentage of time CPU remains idle is 0 %**

THANK YOU