John Kiyak

CS433

Homework 4

Problem 9.1

a)

* Shortest remaining time:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P1 | P1 | | P2 | | P2 | | P1 | | P1 | P1 | | P4 | | P4 | P4 | | P4 | P3 | P3 | P3 |
| 0,1 | 1,2 | | 2,3 | | 3,4 | | 4,5 | | 5,6 | 6,7 | | 7,8 | | 8,9 | 9,10 | | 10,11 | 11,12 | 12,13 | 13,14 |
| P3 | | P3 | | P3 | | P3 | | P3 | | | P3 | | P3 | | |
| 14,15 | | 15,16 | | 16,17 | | 17,18 | | 18,19 | | | 19,20 | | 20,21 | | |

* Nonpreemptive priority:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P1 | P1 | | P1 | | P1 | | P1 | | P2 | P2 | | P4 | | P4 | P4 | | P4 | P3 | P3 | P3 |
| 0,1 | 1,2 | | 2,3 | | 3,4 | | 4,5 | | 5,6 | 6,7 | | 7,8 | | 8,9 | 9,10 | | 10,11 | 11,12 | 12,13 | 13,14 |
| P3 | | P3 | | P3 | | P3 | | P3 | | | P3 | | P3 | | |
| 14,15 | | 15,16 | | 16,17 | | 17,18 | | 18,19 | | | 19,20 | | 20,21 | | |

* Round Robin:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P1 | P1 | | P1 | | P2 | | P2 | | P1 | P1 | | P3 | | P3 | P3 | | P4 | P4 | P4 | P3 |
| 0,1 | 1,2 | | 2,3 | | 3,4 | | 4,5 | | 5,6 | 6,7 | | 7,8 | | 8,9 | 9,10 | | 10,11 | 11,12 | 12,13 | 13,14 |
| P3 | | P3 | | P4 | | P3 | | P3 | | | P3 | | P3 | | |
| 14,15 | | 15,16 | | 16,17 | | 17,18 | | 18,19 | | | 19,20 | | 20,21 | | |

b)

* Shortest remaining time Average Waiting Time:
  + Waitingtime = Finish Time – (Arrival Time + Burst Time)
  + AverageWaitingTime = Sum of the waiting times of all processes / Total number of processes
  + P1
    - Finish Time = (7 units \* 10 ms) = 70ms
    - Arrival Time = 0 ms
    - Burst Time = 50
    - WaitingTime = 70 – (0+50) = 20
  + P2
    - Finish Time = (4 units \* 10 ms) = 40ms
    - Arrival Time = 20 ms
    - Burst Time = 20
    - WaitingTime = 40 – (20+20) = 0
  + P3
    - Finish Time = (21 units \* 10 ms) = 210ms
    - Arrival Time = 100 ms
    - Burst Time = 40
    - WaitingTime = 210 – (100+40) = 70
  + P4
    - Finish Time = (11 units \* 10 ms) = 110ms
    - Arrival Time = 40 ms
    - Burst Time = 60
    - WaitingTime = 110 – (40+60) = 10
  + Average Waiting Time = (20 + 0 + 70 + 10) / 4 = 25 ms
* Nonpreemptive priority Average Waiting Time:
  + Waitingtime = Finish Time – (Arrival Time + Burst Time)
  + AverageWaitingTime = Sum of the waiting times of all processes / Total number of processes
  + P1
    - Finish Time = (5 units \* 10 ms) = 50ms
    - Arrival Time = 0 ms
    - Burst Time = 50
    - WaitingTime = 50 – (0+50) = 0
  + P2
    - Finish Time = (7 units \* 10 ms) = 70ms
    - Arrival Time = 20 ms
    - Burst Time = 20
    - WaitingTime = 70 – (20+20) = 30
  + P3
    - Finish Time = (21 units \* 10 ms) = 210ms
    - Arrival Time = 100 ms
    - Burst Time = 40
    - WaitingTime = 210 – (100+40) = 70
  + P4
    - Finish Time = (11 units \* 10 ms) = 110ms
    - Arrival Time = 40 ms
    - Burst Time = 60
    - WaitingTime = 110 – (40+60) = 10
  + Average Waiting Time = (0 + 30 + 70 + 10) / 4 = 27.5 ms
* Round Robin Average Waiting Time:
  + Waitingtime = Finish Time – (Arrival Time + Burst Time)
  + AverageWaitingTime = Sum of the waiting times of all processes / Total number of processes
  + P1
    - Finish Time = (7 units \* 10 ms) = 70ms
    - Arrival Time = 0 ms
    - Burst Time = 50
    - WaitingTime = 70 – (0+50) = 20
  + P2
    - Finish Time = (5 units \* 10 ms) = 50ms
    - Arrival Time = 20 ms
    - Burst Time = 20
    - WaitingTime = 50 – (20+20) = 10
  + P3
    - Finish Time = (21 units \* 10 ms) = 210ms
    - Arrival Time = 100 ms
    - Burst Time = 40
    - WaitingTime = 210 – (100+40) = 70
  + P4
    - Finish Time = (17 units \* 10 ms) = 170ms
    - Arrival Time = 40 ms
    - Burst Time = 60
    - WaitingTime = 170 – (40+60) = 70
  + Average Waiting Time = (20 + 10 + 70 + 70) / 4 = 42.5ms

Problem 9.2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Process | A | B | C | D | E |
| Arrival Time | 0 | 1 | 3 | 9 | 12 |
| Service Time | 3 | 5 | 2 | 5 | 5 | Mean |

FCFS

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Finish Time | 3 | 8 | 10 | 15 | 20 |
| Turnaround Time | 3 | 7 | 7 | 6 | 8 | 6.2 |
| T(r) / T(s) | 1.0 | 1.4 | 3.5 | 1.2 | 1.6 | 1.74 |

RRq = 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Finish Time | 5 | 11 | 7 | 18 | 20 |
| Turnaround Time | 5 | 10 | 4 | 9 | 8 | 7.2 |
| T(r) / T(s) | 1.67 | 2 | 2 | 1.8 | 1.6 | 1.814 |

RRq = 4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Finish Time | 3 | 10 | 9 | 19 | 20 |
| Turnaround Time | 3 | 9 | 6 | 10 | 8 | 7.2 |
| T(r) / T(s) | 1 | 1.8 | 3 | 2 | 1.6 | 1.88 |

SPN

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Finish Time | 3 | 10 | 5 | 15 | 20 |
| Turnaround Time | 3 | 9 | 2 | 6 | 7 | 5.60 |
| T(r) / T(s) | 1 | 1.8 | 1 | 1.2 | 1.6 | 1.32 |

SRT

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Finish Time | 3 | 10 | 5 | 15 | 20 |
| Turnaround Time | 3 | 9 | 2 | 6 | 8 | 5.6 |
| T(r) / T(s) | 1 | 1.8 | 1 | 1.2 | 1.6 | 1.32 |

HRRN

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Finish Time | 3 | 8 | 10 | 15 | 20 |
| Turnaround Time | 3 | 7 | 7 | 6 | 8 | 6.2 |
| T(r) / T(s) | 1 | 1.4 | 3.5 | 1.2 | 1.6 | 1.74 |

FBq=1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Finish Time | 7 | 11 | 6 | 18 | 20 |
| Turnaround Time | 7 | 10 | 3 | 9 | 8 | 6.6 |
| T(r) / T(s) | 2.33 | 2 | 1.5 | 1.8 | 1.6 | 1.846 |

FBq = 2^i

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Finish Time | A | B | C | D | E |
| Turnaround Time | 0 | 1 | 3 | 9 | 12 | 8.60 |
| T(r) / T(s) | 3 | 6 | 4 | 5 | 2 | 2.56 |



