

# University of Central Florida

DEPARTMENT OF ELECTRICAL ENGINEERING & COMPUTER SCIENCE

## COMPUTER SCIENCE DIVISION

### CGS 3763 Operating Systems

#### Assignment 2

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#### Formulas

1. Turn Around Time = Completion Time - Arrival Time
2. Waiting Time = Turn Around Time - Burst Time
3. Response Time = Waiting Time + Arrival Time

1. Consider the arrival time and burst time of four jobs specified in the table below.
  - a. Apply the **Shortest Remaining Time to Finish (SRTF) with IO** operating system algorithm.
  - b. Generate a table to identify the process id, exit time, turn around time, waiting time, and response time.
  - c. Generate a Gantt chart to show how/when each process is executed by the CPU.
  - d. Generate a Gantt chart to show how/when each process enters/leaves the waiting state for IO.
  - e. Calculate the average turn around time of the processes.
  - f. Calculate the average wait time of the processes.
  - g. Calculate the average response time of the processes.

Process ID	Arrival Time	Burst Time, IO Burst Time, Burst Time
1	0	4, 1, 3
2	2	2, 2, 3
3	4	6, 3, 4
4	6	4, 3, 4

Time Table

Process ID	Total Burst Time	Exit Time	Turn Around Time	Waiting Time	Response Time
1	7	8	8	1	1
2	5	14	12	7	9
3	10	33	29	19	23
4	8	23	17	9	15

CPU Gantt Chart

Process ID	P1	P1	P2	P1	P1	P2	P4	P2	P4	P3	P4	P3		P3	
Time	0	2	4	5	6	8	9	11	14	16	19	23	26	29	33

IO Gantt Chart

Process ID		P1		P2		P4		P3	
Time	0	4	5	9	11	16	19	26	29

Average turn around time = 16.5

Average waiting time = 9

Average response time = 12

2. Consider the arrival and burst time of five jobs specified in the table below.
- Apply the **Round Robin** operating system scheduling algorithm.
  - Time quantum of the system is 6 units.**
  - Generate a table to identify the process id, exit time, turn around time, waiting time, and response time.
  - Generate a Gantt chart to show how/when each process is executed.
  - Calculate the average turn around time of the processes.
  - Calculate the average wait time of the processes.
  - Calculate the average response time of the processes.

Process ID	Arrival Time	Burst Time
1	7	5
2	1	3
3	3	8
4	5	10
5	2	6

**Time Table**

Process ID	Exit Time	Turn Around Time	Waiting Time	Response Time
1	27	20	15	22
2	4	3	0	1
3	29	26	18	21
4	33	28	18	23
5	10	8	2	4

**Gantt Chart**

Process ID		P2	P5	P3	P4	P1	P3	P4	
Time	0	1	4	10	16	22	27	29	33

**Average Turn Around time = 17**

**Average waiting time = 10.6**

**Average response time = 14.4**

3. Consider the arrival time and burst time of six jobs specified in the table below.
- Apply the **Highest Response Ratio Next (HRRN)** operating system scheduling algorithm.
  - Generate a table to identify the process id, exit time, turn around time, waiting time, and response time.
  - Generate a Gantt chart to show how/when each process is executed.
  - Calculate the average turn around time of the processes.
  - Calculate the average wait time of the processes.
  - Calculate the average response time of the processes.

Process ID	Arrival Time	Burst Time
1	7	5
2	1	3
3	3	8
4	5	10
5	2	6

**Time Table**

Process ID	Exit Time	Turn Around Time	Waiting Time	Response Time
1	23	16	11	18
2	4	3	0	1
3	18	15	7	10
4	33	28	18	23
5	10	8	2	4

**Gantt Chart**

Process ID		P2	P5	P3	P1	P4	
Time	0	1	4	10	18	23	33

**Average Turn Around time = 15**

**Average waiting time = 7.6**

**Average response time = 11.2**

4. Consider the arrival time and burst time of seven jobs specified in the table below.
- Apply the **Priority Preemptive** operating system scheduling algorithm.
  - Given Priority, the lower the value, the higher the priority.**
  - Generate a table to identify the process id, exit time, turn around time, waiting time, and response time.
  - Generate a Gantt chart to show how/when each process is executed.
  - Calculate the average turn around time of the processes.
  - Calculate the average wait time of the processes.
  - Calculate the average response time of the processes.

Process ID	Arrival Time	Burst Time	Priority
1	7	5	6
2	1	3	9
3	3	8	4
4	5	10	8
5	2	6	1

**Time Table**

Process ID	Exit Time	Turn Around Time	Waiting Time	Response Time
1	21	14	9	16
2	33	32	0	1
3	16	13	5	8
4	31	26	16	21
5	8	6	0	2

**Gantt Chart**

Process ID		P2	P5	P5	P5	P5	P3	P1	P4	P2	
Time	0	1	2	3	5	7	8	16	23	31	33

Average Turn Around time = 18.2

Average waiting time = 11.8

Average response time = 9.6

5. Consider the arrival time and burst time of three jobs specified in the table below.
- Apply the **Priority Non-preemptive** operating system scheduling algorithm.
  - Given Priority, the lower the value, the higher the priority.**
  - Generate a table to identify the process id, exit time, turn around time, waiting time, and response time.
  - Generate a Gantt chart to show how/when each process is executed.
  - Calculate the average turn around time of the processes.
  - Calculate the average wait time of the processes.
  - Calculate the average response time of the processes.

Process ID	Arrival Time	Burst Time	Priority
1	7	5	6
2	1	3	9
3	3	8	4
4	5	10	8
5	2	6	1

**Time Table**

Process ID	Exit Time	Turn Around Time	Waiting Time	Response Time
1	23	16	11	18
2	4	3	0	1
3	18	15	7	10
4	33	28	18	23
5	10	8	2	4

**Gantt Chart**

Process ID		P2	P5	P3	P1	P4	
Time		1	4	10	18	23	33

Average Turn Around time = 15

Average waiting time = 7.6

Average response time = 11.2

6. Compare and analyze the results from the four scheduling algorithms.

Scheduling algorithm	Average turn around time	Average wait time	Average response time
Round Robin	17	10.6	14.4
HRRN	15	7.6	11.2
Priority Preemptive	18.2	11.8	9.6
Priority Non-preemptive	15	7.6	11.2

7. Which OS process scheduling algorithm performed the best?

HRRN and priority non preemptive performed the best.