CS 342 - 03
Operating System
Homework 2

Spring 2022

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- **Question 1:** There are 2 processes after the first fork, 4 processes after the second fork, 8 processes after third fork, 12 processes after fourth fork and after executing the last fork there will be 24 processes in total. 23 child processes and 1 main processes.

- **Question 2:** Speedup = 1 / ((1 - S) + S / N)
  - ➡ 4 = 1 / ((1 - S) + S / 8)

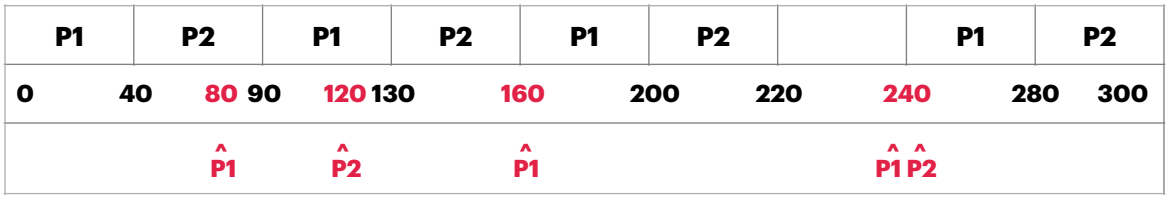
    S = 1 / 7
  - ➡ Speedup = 1 / ((1 - (1 / 7)) + (1 / 7) / 16)

    Speedup <= 5,09

- **Question 3:** Output is: 10 20 50 30 50

First, the parent process prints the number 10. Then the first child process changes the value of x to 20 and prints it. Then changes the value of x to 50. After exiting the if, it prints the current x value as 50. Then the third child process changes the value of x to 30 and prints it. Then it prints the value of x which is equal to 50 again.

- **Question 4:**



The deadlines of process 1 (P1) are; 80, 160, 240 and 320. The deadlines of process 2 (P2) are; 120, 240 and 360. In EDF scheduling, priority is given according to the deadlines of the processors. Since the deadline of the P1 processor is earlier than the P2 processor, the priority is given to the P1 processor.

- **Question 5 - A:** FCFS (First Come First Serve)

A	B	C	D	E
0 15 30 35 45 100	180	240	300	350
^ B ^ C ^ D ^ E				

➡ **A:** Finish time is 100, turnaround time is 100 and waiting time is 0 because A executed first.

➡ **B:** Finish time is 180, turnaround time is 180 - 15 = 165 and waiting time is 100 - 15 = 85 because it is waiting A to be executed.

➡ **C:** Finish time is 240, turnaround time is 240 - 30 = 210 and waiting time is 180 - 30 = 150.

➡ **D:** Finish time is 300, turnaround time is 300 - 35 = 265 and waiting time is 240 - 35 = 205.

➡ **E:** Finish time is 350, turnaround time is 350 - 45 = 305 and waiting time is 300 - 45 = 255.

- **Question 5 - B:** SJF (Sortest Job First)

A	E	C	D	B
0 15 30 35 45 100	150	210	270	350
^ B ^ C ^ D ^ E				

➡ **A:** Finish time is 100, turnaround time is 100 and waiting time is 0 because A is executed first.

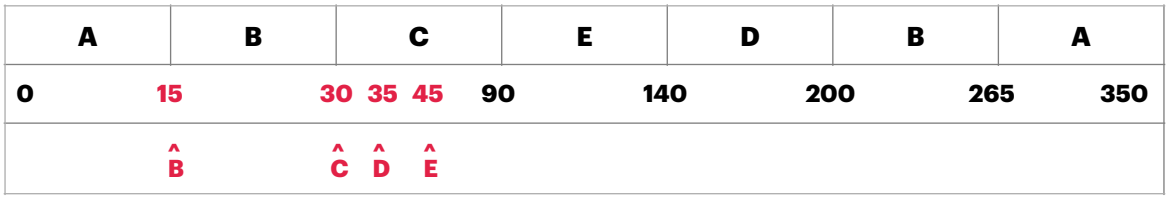
➡ **B:** Finish time is 350, turnaround time is 350 - 15 = 335 and waiting time is 270 - 15 = 255.

➡ **C:** Finish time is 210, turnaround time is 210 - 30 = 180 and waiting time is 150 - 30 = 120.

➡ **D:** Finish time is 270, turnaround time is 270 - 35 = 235 and waiting time is 210 - 35 = 175.

➡ **E:** Finish time is 150, turnaround time is 150 - 45 = 105 and waiting time is 100 - 45 = 55.

- **Question 5 - C:** SRTF (Shortest Remaining Time First)



➡ **A:** Finish time is 350, turnaround time is 350 and waiting time is 350 - 100 = 250.

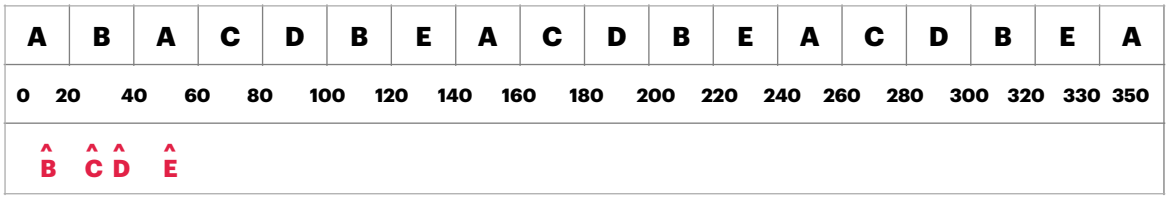
➡ **B:** Finish time is 265, turnaround time is 265 - 15 = 250 and waiting time is 265 - (15 + 80) = 170.

➡ **C:** Finish time is 90, turnaround time is 90 - 30 = 60 and waiting time is 0 because C starts executing when its deadline starts.

➡ **D:** Finish time is 200, turnaround time is 200 - 35 = 165 and waiting time is 200 - (35 + 60) = 105.

➡ **E:** Finish time is 140, turnaround time is 140 - 45 = 95 and waiting time is 140 - (45 + 50) = 45.

- **Question 5 - D:** RR (Round-Robin) (q = 20)



➡ **A:** Finish time is 350, turnaround time is 350 and waiting time is 350 - 100 = 250.

➡ **B:** Finish time is 320, turnaround time is 320 - 15 = 305 and waiting time is 320 - (15 + 80) = 225.

➡ **C:** Finish time is 280, turnaround time is 280 - 30 = 250 and waiting time is 280 - (30 + 60) = 190.

➡ **D:** Finish time is 300, turnaround time is 300 - 35 = 265 and waiting time is 300 - (35 + 60) = 205.

➡ **E:** Finish time is 330, turnaround time is 330 - 45 = 285 and waiting time is 330 - (45 + 50) = 235.

- **Question 5 - E:** Priority with RR (Round-Robin) (q = 20)

A	B	D	B	D	B	D	B	C	E	C	E	C	E	A	A	A	A	A
0	15	35	55	75	95	115	135	155	175	195	215	235	255	265	285	305	325	345	350
	^ B	^ C	^ D		^ E														

➡ **A:** Finish time is 350, turnaround time is 350 and waiting time is 350 - 100 = 250.

➡ **B:** Finish time is 155, turnaround time is 155 - 15 = 140 and waiting time is 155 - (15 + 80) = 60.

➡ **C:** Finish time is 255, turnaround time is 255 - 30 = 225 and waiting time is 255 - (30 + 60) = 165.

➡ **D:** Finish time is 135, turnaround time is 135 - 35 = 100 and waiting time is 135 - (35 + 60) = 40.

➡ **E:** Finish time is 265, turnaround time is 265 - 45 = 220 and waiting time is 265 - (45 + 50) = 170.

- **Question 6:** Process A: $T_0 = 10$ ms and α = 0,8

$$T_1 = (0.8 * 10) + (0{,}8 * 10) = 16$$

$$T_2 = (0{,}8 * 20) + (0{,}8 * 16) = 28{,}8$$

$$T_3 = (0{,}8 * 20) + (0{,}8 * 28{,}8) = 39{,}04$$

$$T_4 = (0{,}8 * 30) + (0{,}8 * 39{,}04) = 55{,}23$$

$$T_5 = (0{,}8 * 40) + (0{,}8 * 55{,}23) = 76{,}18$$

Process B: $T_0 = 10$ ms and α = 0,8

$$T_1 = (0.8 * 10) + (0{,}8 * 10) = 16$$

$$T_2 = (0{,}8 * 20) + (0{,}8 * 16) = 28{,}8$$

$$T_3 = (0{,}8 * 30) + (0{,}8 * 28{,}8) = 47{,}04$$

$$T_4 = (0{,}8 * 40) + (0{,}8 * 47{,}04) = 69{,}63$$

As a result, process B will be picked next to use the CPU because predicted values of process B is less than predicted values of process A.

- **Question 7:** Output is:

1000 2200 300

100 2200 300

Since there is a new variable x initialization in foo, this x value will be local. Changes in variable x will not affect global x value. First line of the output is belong to foo function. In foo, local x varible is increased to 1000. Then, global y variable is increased to 2200. After printing values in foo function, in main, global y value is updated to 2200. However, global x variable is still 100. So that, second line of the output which belongs main function, will be 100, 2200, 300.