COP 4610 – Programming Assignment

CPU Scheduler

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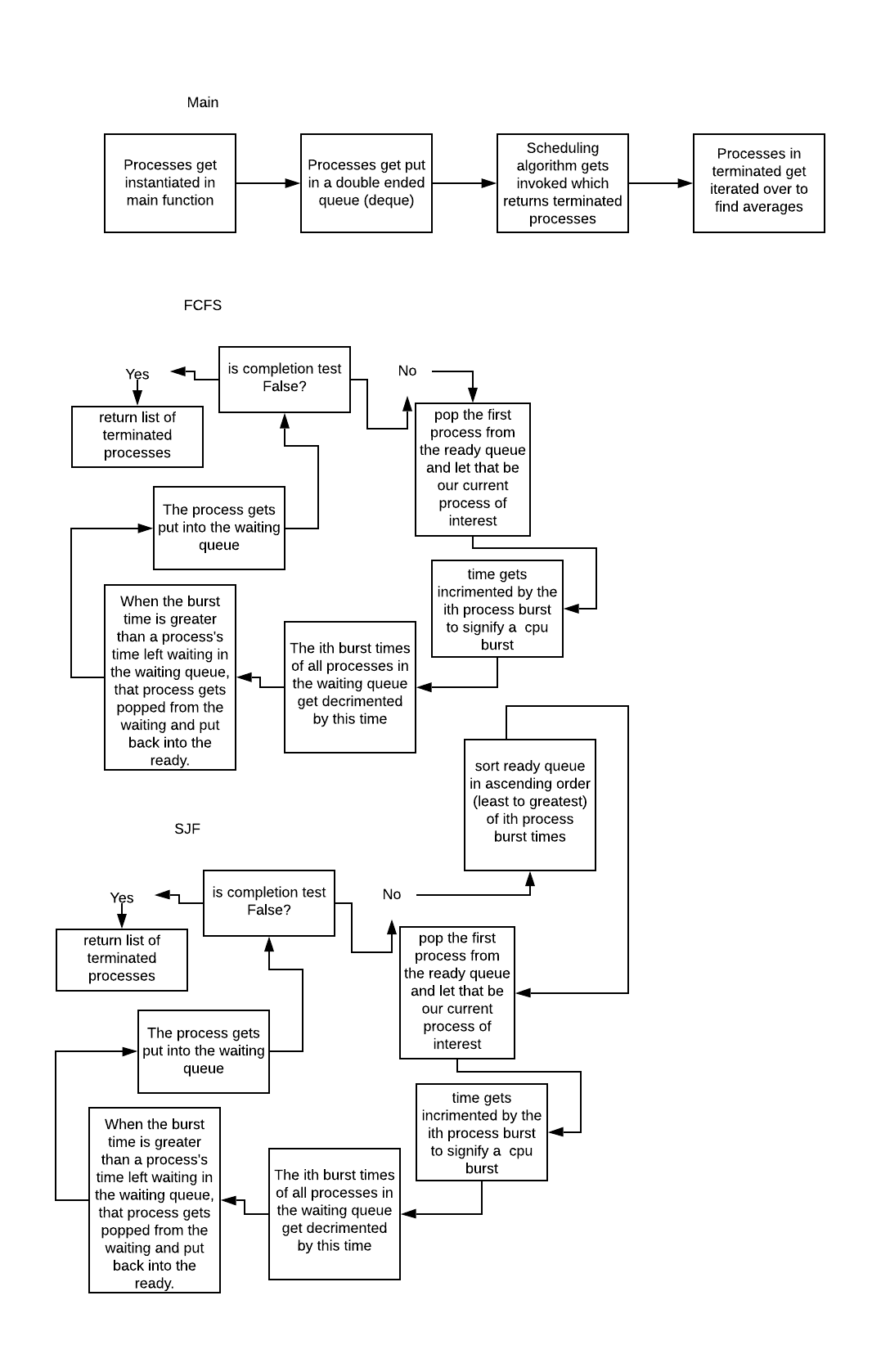
# Introduction

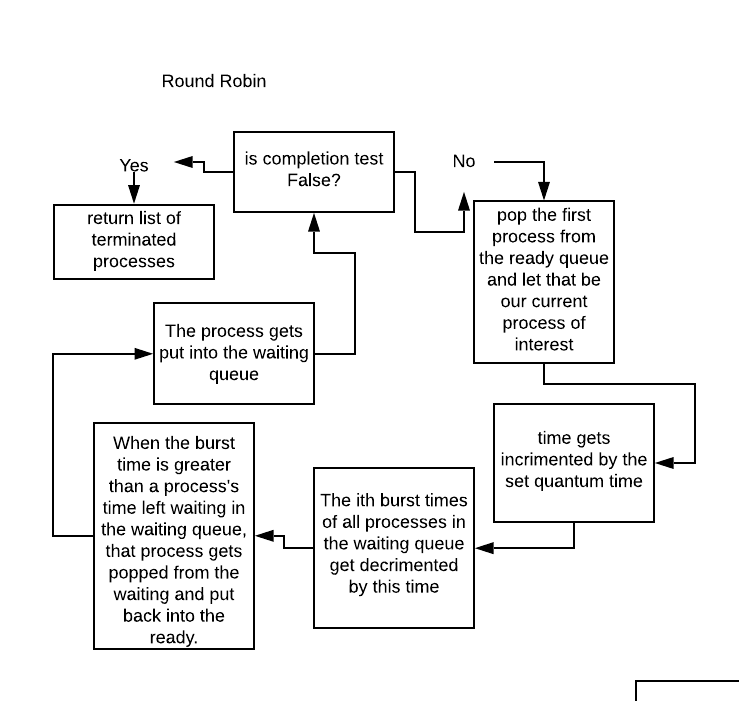
A process is any sort of activity that requires the resources the computer, such as memory or I/O. A process can be in one of 5 states. The new state where a process has just been initialized. Ready state is where the process is able run, but not currently running. Running is when there is a CPU burst or execution taking place. Waiting is the amount of time a process spends waiting for the next CPU cycle. Terminated is when a process has finished executing and has retired.

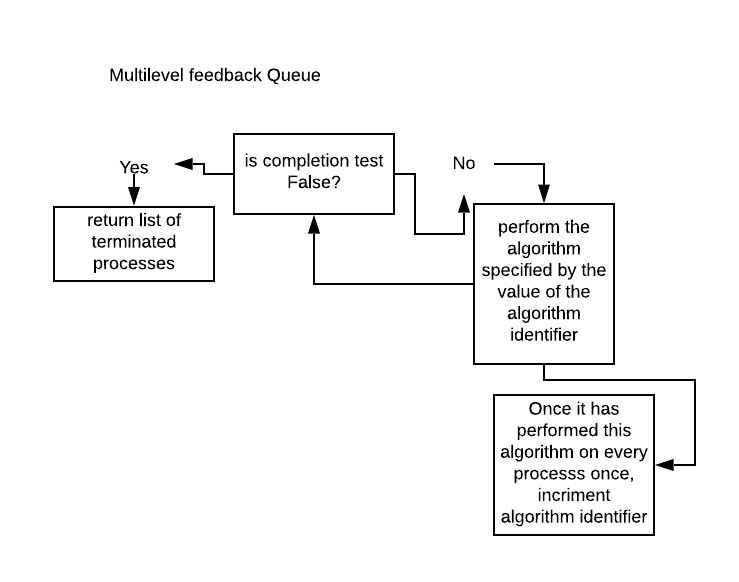
A process scheduler helps regulate the transition between these states. When a process or a group of processes are in the ready queue, there needs to be a mechanism that handles which process gets CPU attention and for how long. The process scheduler decides which process to put into the running, waiting or ready state. The exact method on how this is done depends on the type of algorithm of the scheduler.

The three algorithms discussed in this assignment are first come first serve (FCFS), shortest job first(SJF), round robin and multi-level feedback queue (MLFQ). In FCFS, process are executed by order of their arrival time. In SJF, processes are executed in order of the shortest time burst. In practice, SJF cannot be implemented unless burst times are known in advance. However, in this assignment, this scenario exists. Round robin is similar to FCFS. It differs in that round robin has a quantum time that a burst cannot exceed. Multilevel feedback queue is when the scheduler will perform some sort of combination of the afore mentioned algorithms.

To simulate these algorithms, I use Python 3 as my programming language. The advantages of using this language is that it is fairly readable and easy to type. The disadvantages is that it is resource intensive because it imports a module called collections.







A close up of text on a white background

Description automatically generated

# Discussion

For first come first serve, have the parameters ready\_queue, waiting queue, time and cpu\_util. The ready queue and waiting queue hold objects called processes. These process have the attribute of waiting time, turnaround time, and response time. It also has the name of the process for output, and a list of burst times of that process. It also has an iterator i that keeps track of which burst time a process is on. It also has an attribute called completed which is used as the condition for the while loop in FCFS. This Boolean value returns true if all the processes in the ready and waiting queue have every single process’ attribute iscompleted equal to true. If that is the case, it will exit the loop and we know that FCFS has completed. If the ready queue has no processes, my algorithm increments time by one until it has subtracted all burst times of process in the waiting queue by 0. This case implies there is no cpu utilization and that is why the cpu utilization variable is not being incremented. If this marginal case is not active, then it will pop a process from the ready queue and this process will be the first participant in our algorithm. It first checks if the process is not complete before it proceed, however.

The way the program recognizes a cpu burst has occurred is it increments time by this burst. Cpu utilization encounters the same fate in this instance. If the response time of this process is uninitialized, it becomes initialized. Update waiting is function that is called to subtract all processes’ burst times (i/o times in this scenario) in the waiting queue by the current cpu burst. If a process in the waiting queue is done waiting, it gets popped and added back into the ready queue. It is then sorted to signify that this a process that is up next after all the existing processes in the ready queue has executed. This functionality is well suited for a doubly ended queue, or as it is known in Python, a deque. The process’ iterator increments by 1 to show that this process is now in i/o time. If the modulus operator is applied to this iterator and 2, a 0 means the process is on CPU and a 1 means it is on I/O. This relationship can be extended to if a process’ incrementor is odd or even. This iterator also renders a process complete attribute true if the iterator is greater than or equal to the number of burst times. At the same stage, the process gets added to the terminated queue. This process is then added to the waiting queue. CPU utilization is calculated by dividing cpu\_utilization by time (times 100). When it finally exits the while loop, the

SJF is the same procedure as FCFS with the exception that the ready queue is sorted initially. It is also sorted in update waiting where if a process’ I/O burst gets decremented to 0, the process gets put into ready and sorted again from least to greatest. These steps ensure that the ready queue has processes are sorted and executed in order of the process that have the shortest cpu burst for that particular phase.

MLFQ calls 1 function twice, Round Robin. Round robin is similar to FCFS, but differs in that it is given an additional parameter called quantum time. Every time that update waiting is called, the processes in the waiting queue’s I/O time will be subtracted by the set quantum variable. However, if the CPU burst at this stage is less than the quantum time, the processes in the waiting queue’s I/O time will be subtracted by this CPU time as in FCFS. Round robin executes only on phase, meaning that when all the processes are popped from the ready queue and put into the waiting queue, Round Robin has done its job.

On the second time that MLFQ called Round Robin, it is passed the values of the new ready and new waiting queue. This step in implemented because if we pass the values the initial ready queue passed in the first Round Robin call, it will be an empty queue. Therefore, Round robin is unique in that it calls update\_waiting twice, once for the queues passed by the parameters, and once for temporary queues that store the value of the processes whose incrementor are greatest. An illustration of this flow is in the chart section. In the first Round robin call, there are no processes in the initial waiting queue. When there is a CPU burst the process will be added next waiting. Next waiting in turn adds to next ready when it has finished bursting. Then, these values will be passed to the second round of round robin. After Round robin is run twice, MLFQ executes FCFS and then it exits the function.

Average turn around time is calculated when a process has completed and is assigned the value of the current time. Average waiting time was calculated when update waiting was called. It adds the process’s waiting time by the I/O time. I would subtract the waiting time by the difference of the burst and the I/O time if the burst is greater than I/O time of the process in the waiting queue.

I used Visual Studios Code as my IDE. This IDE has a debug feature which always you to put a break point a place where there an error occurs. During this debug, you have the option to step into a function as see what is going on behind the scenes. There is a menu with all the real time values of each queue and the values of each process’ attribute. This process of verification was useful in comparing the results of the simulations done by hand to the simulations done by the program.

# Simulations

FCFS

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p3

p4

p5

p6

p7

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p1

burst time: [5, 27, 3, 31, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 27

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p4

p5

p6

p7

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, 48, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 48

process: p1

burst time: [5, 23, 3, 31, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 23

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p5

p6

p7

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, 40, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 40

process: p3

burst time: [8, 33, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 33

process: p1

burst time: [5, 15, 3, 31, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 15

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p6

p7

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, 37, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 37

process: p4

burst time: [3, 35, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 35

process: p3

burst time: [8, 30, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 30

process: p1

burst time: [5, 12, 3, 31, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 12

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p7

p8

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p5

burst time: [16, 24, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 24

process: p2

burst time: [4, 21, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 21

process: p4

burst time: [3, 19, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 19

process: p3

burst time: [8, 14, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 14

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p8

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p6

burst time: [11, 22, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 22

process: p5

burst time: [16, 13, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 13

process: p2

burst time: [4, 10, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 10

process: p4

burst time: [3, 8, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 8

process: p3

burst time: [8, 3, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p1

p3

p4

p2

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, 46, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 46

process: p6

burst time: [11, 8, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p3

p4

p2

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, 42, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 42

process: p8

burst time: [4, 14, 5, 33, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 14

process: p6

burst time: [11, 4, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 4

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p4

p2

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, 39, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 39

process: p1

burst time: [5, -4, 3, 31, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 31

process: p8

burst time: [4, 11, 5, 33, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 11

process: p6

burst time: [11, 1, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p2

p5

p6

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -11, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 41

process: p7

burst time: [14, 27, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 27

process: p1

burst time: [5, -4, 3, 19, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 19

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p5

p6

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -6, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 41

process: p3

burst time: [8, -11, 12, 37, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 37

process: p7

burst time: [14, 23, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 23

process: p1

burst time: [5, -4, 3, 15, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 15

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p6

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 44

process: p4

burst time: [3, -6, 4, 36, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 36

process: p3

burst time: [8, -11, 12, 32, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 32

process: p7

burst time: [14, 18, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 18

process: p1

burst time: [5, -4, 3, 10, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 10

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p8

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, 27, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 27

process: p5

burst time: [16, -1, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 21

process: p4

burst time: [3, -6, 4, 19, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 19

process: p3

burst time: [8, -11, 12, 15, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 15

process: p7

burst time: [14, 1, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p1

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, 23, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 23

process: p5

burst time: [16, -1, 17, 17, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 17

process: p4

burst time: [3, -6, 4, 15, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 15

process: p3

burst time: [8, -11, 12, 11, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 11

process: p6

burst time: [11, -11, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, 33, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 33

process: p2

burst time: [4, -4, 5, 18, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 18

process: p5

burst time: [16, -1, 17, 12, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 12

process: p4

burst time: [3, -6, 4, 10, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 10

process: p3

burst time: [8, -11, 12, 6, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 6

process: p6

burst time: [11, -11, 4, 3, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p1

burst time: [5, -4, 3, -7, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 43

process: p8

burst time: [4, -1, 5, 28, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 28

process: p2

burst time: [4, -4, 5, 13, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 13

process: p5

burst time: [16, -1, 17, 7, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 7

process: p4

burst time: [3, -6, 4, 5, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 5

process: p3

burst time: [8, -11, 12, 1, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p3

p4

p5

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, -3, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 41

process: p1

burst time: [5, -4, 3, -7, 5, 26, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 26

process: p8

burst time: [4, -1, 5, 11, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 11

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p4

p5

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, -3, 17, 36, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 36

process: p1

burst time: [5, -4, 3, -7, 5, 21, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 21

process: p6

burst time: [11, -11, 4, -2, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 10

process: p8

burst time: [4, -1, 5, 6, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 6

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p5

p2

p8

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -11, 12, -16, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 65

process: p7

burst time: [14, -3, 17, 18, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 18

process: p1

burst time: [5, -4, 3, -7, 5, 3, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p2

p8

p6

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -11, 12, -16, 18, 60, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 60

process: p4

burst time: [3, -6, 4, -12, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 45

process: p7

burst time: [14, -3, 17, 13, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 13

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p8

p6

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -11, 12, -16, 18, 55, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 55

process: p4

burst time: [3, -6, 4, -12, 5, 40, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 40

process: p5

burst time: [16, -1, 17, -10, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 36

process: p7

burst time: [14, -3, 17, 8, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p6

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -11, 12, -16, 18, 48, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 48

process: p2

burst time: [4, -4, 5, -4, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 42

process: p4

burst time: [3, -6, 4, -12, 5, 33, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 33

process: p5

burst time: [16, -1, 17, -10, 5, 29, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 29

process: p7

burst time: [14, -3, 17, 1, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p1

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 51

process: p3

burst time: [8, -11, 12, -16, 18, 42, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 42

process: p2

burst time: [4, -4, 5, -4, 7, 36, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 36

process: p4

burst time: [3, -6, 4, -12, 5, 27, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 27

process: p5

burst time: [16, -1, 17, -10, 5, 23, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 23

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, 45, 14, 73, 16, 87, 6]

time left in waiting: 45

process: p3

burst time: [8, -11, 12, -16, 18, 36, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 36

process: p2

burst time: [4, -4, 5, -4, 7, 30, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 30

process: p4

burst time: [3, -6, 4, -12, 5, 21, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 21

process: p5

burst time: [16, -1, 17, -10, 5, 17, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 17

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 12

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, 41, 14, 73, 16, 87, 6]

time left in waiting: 41

process: p3

burst time: [8, -11, 12, -16, 18, 32, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 32

process: p2

burst time: [4, -4, 5, -4, 7, 26, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 26

process: p1

burst time: [5, -4, 3, -7, 5, -2, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 18

process: p4

burst time: [3, -6, 4, -12, 5, 17, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 17

process: p5

burst time: [16, -1, 17, -10, 5, 13, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 13

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, 8, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, -3, 17, -5, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 42

process: p8

burst time: [4, -1, 5, -12, 6, 30, 14, 73, 16, 87, 6]

time left in waiting: 30

process: p3

burst time: [8, -11, 12, -16, 18, 21, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 21

process: p2

burst time: [4, -4, 5, -4, 7, 15, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 15

process: p1

burst time: [5, -4, 3, -7, 5, -2, 4, 7, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 7

process: p4

burst time: [3, -6, 4, -12, 5, 6, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 6

process: p5

burst time: [16, -1, 17, -10, 5, 2, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 2

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p4

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, -3, 17, -5, 11, 35, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 35

process: p8

burst time: [4, -1, 5, -12, 6, 23, 14, 73, 16, 87, 6]

time left in waiting: 23

process: p3

burst time: [8, -11, 12, -16, 18, 14, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 14

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, -3, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 14

process: p2

burst time: [4, -4, 5, -4, 7, 8, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p1

p2

p6

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 26

process: p7

burst time: [14, -3, 17, -5, 11, 19, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 19

process: p8

burst time: [4, -1, 5, -12, 6, 7, 14, 73, 16, 87, 6]

time left in waiting: 7

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p2

p6

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 51

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, 23, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 23

process: p7

burst time: [14, -3, 17, -5, 11, 16, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 16

process: p8

burst time: [4, -1, 5, -12, 6, 4, 14, 73, 16, 87, 6]

time left in waiting: 4

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p6

p3

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, 45, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 45

process: p1

burst time: [5, -4, 3, -7, 5, -2, 4, 0, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 22

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, 17, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 17

process: p7

burst time: [14, -3, 17, -5, 11, 10, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 10

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p3

p8

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 37

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, 33, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 33

process: p1

burst time: [5, -4, 3, -7, 5, -2, 4, 0, 6, 10, 4, 26, 3, 24, 4]

time left in waiting: 10

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, 5, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p8

p7

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 28, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 28

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, 24, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 24

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, -3, 7, -2, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 18

process: p1

burst time: [5, -4, 3, -7, 5, -2, 4, 0, 6, 1, 4, 26, 3, 24, 4]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p7

p5

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 21

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 14, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 14

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, 10, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 10

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, -3, 7, -2, 9, 4, 12, 24, 15, 30, 8]

time left in waiting: 4

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p5

p1

p6

p4

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, 73, 16, 87, 6]

time left in waiting: 73

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, 7, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 7

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p1

p6

p4

p2

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, 58, 16, 87, 6]

time left in waiting: 58

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 21

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p6

p4

p2

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, 51, 16, 87, 6]

time left in waiting: 51

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 31

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, 14, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 14

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p4

p2

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, 47, 16, 87, 6]

time left in waiting: 47

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, 27, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 27

process: p1

burst time: [5, -4, 3, -7, 5, -2, 4, 0, 6, -13, 4, 26, 3, 24, 4]

time left in waiting: 26

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, 10, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 10

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p2

p3

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, 35, 16, 87, 6]

time left in waiting: 35

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, -3, 7, -2, 9, -10, 12, 24, 15, 30, 8]

time left in waiting: 24

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, 15, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 15

process: p1

burst time: [5, -4, 3, -7, 5, -2, 4, 0, 6, -13, 4, 14, 3, 24, 4]

time left in waiting: 14

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p3

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 61

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, 31, 16, 87, 6]

time left in waiting: 31

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, -3, 7, -2, 9, -10, 12, 20, 15, 30, 8]

time left in waiting: 20

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, 11, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 11

process: p1

burst time: [5, -4, 3, -7, 5, -2, 4, 0, 6, -13, 4, 10, 3, 24, 4]

time left in waiting: 10

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 76

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, 52, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 52

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, 22, 16, 87, 6]

time left in waiting: 22

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, -3, 7, -2, 9, -10, 12, 11, 15, 30, 8]

time left in waiting: 11

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, 2, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 2

process: p1

burst time: [5, -4, 3, -7, 5, -2, 4, 0, 6, -13, 4, 1, 3, 24, 4]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p1

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, 72, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 72

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 61

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, 48, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 48

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, 18, 16, 87, 6]

time left in waiting: 18

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, -3, 7, -2, 9, -10, 12, 7, 15, 30, 8]

time left in waiting: 7

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, 68, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 68

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, 57, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 57

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, 44, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 44

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, -2, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 32

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, 14, 16, 87, 6]

time left in waiting: 14

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, -3, 7, -2, 9, -10, 12, 3, 15, 30, 8]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, 65, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 65

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, 54, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 54

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, 41, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 41

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, -2, 4, 29, 7, 19, 16, 33, 10]

time left in waiting: 29

process: p1

burst time: [5, -4, 3, -7, 5, -2, 4, 0, 6, -13, 4, -3, 3, 24, 4]

time left in waiting: 24

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, 11, 16, 87, 6]

time left in waiting: 11

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, 52, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 52

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, 41, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 41

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, 28, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 28

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, -2, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 28

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, -2, 4, 16, 7, 19, 16, 33, 10]

time left in waiting: 16

process: p1

burst time: [5, -4, 3, -7, 5, -2, 4, 0, 6, -13, 4, -3, 3, 11, 4]

time left in waiting: 11

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, 37, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 37

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, -3, 7, -2, 9, -10, 12, 0, 15, 30, 8]

time left in waiting: 30

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, 26, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 26

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, 13, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 13

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, -2, 13, 13, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 13

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, -2, 4, 1, 7, 19, 16, 33, 10]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p7

p5

p4

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, -2, 16, 87, 6]

time left in waiting: 87

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, 21, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 21

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, -3, 7, -2, 9, -10, 12, 0, 15, 14, 8]

time left in waiting: 14

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, 10, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 10

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p4

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, -2, 16, 76, 6]

time left in waiting: 76

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, -2, 4, -15, 7, 19, 16, 33, 10]

time left in waiting: 19

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, 10, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 10

process: p6

burst time: [11, -11, 4, -2, 5, -8, 6, -3, 7, -2, 9, -10, 12, 0, 15, 3, 8]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p3

p6

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, -2, 16, 65, 6]

time left in waiting: 65

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, -2, 13, -3, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 21

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, -2, 4, -15, 7, 8, 16, 33, 10]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p6

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, -2, 16, 60, 6]

time left in waiting: 60

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, -3, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 54

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, -2, 13, -3, 11, 16, 6, 13, 3, 11, 4]

time left in waiting: 16

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, -2, 4, -15, 7, 3, 16, 33, 10]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p2

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, -2, 16, 45, 6]

time left in waiting: 45

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, -3, 5, 39, 6, 82, 5, 77, 3]

time left in waiting: 39

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, -1, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 18

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, -2, 13, -3, 11, 1, 6, 13, 3, 11, 4]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, -1, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 41

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, -2, 16, 33, 6]

time left in waiting: 33

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, -3, 5, 27, 6, 82, 5, 77, 3]

time left in waiting: 27

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, -1, 15, 6, 14, 26, 5, 31, 6]

time left in waiting: 6

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, -2, 4, -15, 7, -12, 16, 33, 10]

time left in waiting: 33

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, -1, 4, 25, 9, 31, 7, 43, 8]

time left in waiting: 25

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, -2, 16, 17, 6]

time left in waiting: 17

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, -3, 5, 11, 6, 82, 5, 77, 3]

time left in waiting: 11

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, -2, 4, -15, 7, -12, 16, 27, 10]

time left in waiting: 27

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, -1, 4, 19, 9, 31, 7, 43, 8]

time left in waiting: 19

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, -2, 13, -3, 11, -7, 6, 13, 3, 11, 4]

time left in waiting: 13

process: p8

burst time: [4, -1, 5, -12, 6, -2, 14, -2, 16, 11, 6]

time left in waiting: 11

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, -3, 5, 5, 6, 82, 5, 77, 3]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p8

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, -1, 15, -10, 14, 26, 5, 31, 6]

time left in waiting: 26

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, -2, 4, -15, 7, -12, 16, 13, 10]

time left in waiting: 13

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, -1, 4, 5, 9, 31, 7, 43, 8]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p5

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, -3, 5, -9, 6, 82, 5, 77, 3]

time left in waiting: 82

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, -1, 15, -10, 14, 20, 5, 31, 6]

time left in waiting: 20

process: p7

burst time: [14, -3, 17, -5, 11, -2, 15, -2, 4, -15, 7, -12, 16, 7, 10]

time left in waiting: 7

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, -3, 5, -9, 6, 73, 5, 77, 3]

time left in waiting: 73

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, -1, 15, -10, 14, 11, 5, 31, 6]

time left in waiting: 11

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, -2, 13, -3, 11, -7, 6, -1, 3, 11, 4]

time left in waiting: 11

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, -3, 5, -9, 6, 64, 5, 77, 3]

time left in waiting: 64

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, -1, 4, -1, 9, 31, 7, 43, 8]

time left in waiting: 31

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, -1, 15, -10, 14, 2, 5, 31, 6]

time left in waiting: 2

process: p5

burst time: [16, -1, 17, -10, 5, -5, 16, -4, 7, -2, 13, -3, 11, -7, 6, -1, 3, 2, 4]

time left in waiting: 2

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, -3, 5, -9, 6, 45, 5, 77, 3]

time left in waiting: 45

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, -1, 15, -10, 14, -8, 5, 31, 6]

time left in waiting: 31

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, -1, 4, -1, 9, 12, 7, 43, 8]

time left in waiting: 12

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, -1, 4, -1, 9, 0, 7, 43, 8]

time left in waiting: 43

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, -3, 5, -9, 6, 26, 5, 77, 3]

time left in waiting: 26

process: p3

burst time: [8, -11, 12, -16, 18, -2, 14, -8, 4, -1, 15, -10, 14, -8, 5, 12, 6]

time left in waiting: 12

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -6, 4, -12, 5, -1, 3, -4, 4, -3, 5, -9, 6, 0, 5, 77, 3]

time left in waiting: 77

process: p2

burst time: [4, -4, 5, -4, 7, -8, 12, 0, 9, -1, 4, -1, 9, 0, 7, 12, 8]

time left in waiting: 12

END

total time: 654

cpu utilization %: 84.5565749235474

Average waiting time: 267.0

Average turn-around time: 521.5

Average response time: 24.375

process: p1

waiting time: 191

turn around time: 395

response time : 0

process: p6

waiting time: 138

turn around time: 441

response time : 36

process: p8

waiting time: 258

turn around time: 493

response time : 61

process: p7

waiting time: 234

turn around time: 515

response time : 47

process: p5

waiting time: 211

turn around time: 519

response time : 20

process: p3

waiting time: 296

turn around time: 561

response time : 9

process: p2

waiting time: 362

turn around time: 594

response time : 5

process: p4

waiting time: 446

turn around time: 654

response time : 17

SJF

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p8

p1

p3

p6

p7

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, 35, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 35

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p1

p3

p6

p7

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, 48, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 48

process: p4

burst time: [3, 31, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 31

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p3

p6

p7

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, 44, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 44

process: p4

burst time: [3, 27, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 27

process: p8

burst time: [4, 14, 5, 33, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 14

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p6

p7

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, 39, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 39

process: p1

burst time: [5, 27, 3, 31, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 27

process: p4

burst time: [3, 22, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 22

process: p8

burst time: [4, 9, 5, 33, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 9

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p7

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, 33, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 33

process: p2

burst time: [4, 31, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 31

process: p1

burst time: [5, 19, 3, 31, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 19

process: p4

burst time: [3, 14, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 14

process: p8

burst time: [4, 1, 5, 33, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p7

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, 22, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 22

process: p6

burst time: [11, 22, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 22

process: p2

burst time: [4, 20, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 20

process: p1

burst time: [5, 8, 3, 31, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 8

process: p4

burst time: [3, 3, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p7

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, 33, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 33

process: p3

burst time: [8, 17, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 17

process: p6

burst time: [11, 17, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 17

process: p2

burst time: [4, 15, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 15

process: p1

burst time: [5, 3, 3, 31, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p7

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 41

process: p8

burst time: [4, -10, 5, 29, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 29

process: p3

burst time: [8, 13, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 13

process: p6

burst time: [11, 13, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 13

process: p2

burst time: [4, 11, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 11

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, 38, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 38

process: p1

burst time: [5, -1, 3, 31, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 31

process: p8

burst time: [4, -10, 5, 26, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 26

process: p3

burst time: [8, 10, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 10

process: p6

burst time: [11, 10, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 10

process: p2

burst time: [4, 8, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p2

p3

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, 46, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 46

process: p4

burst time: [3, -2, 4, 24, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 24

process: p1

burst time: [5, -1, 3, 17, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 17

process: p8

burst time: [4, -10, 5, 12, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 12

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p3

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, 42, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 42

process: p4

burst time: [3, -2, 4, 20, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 20

process: p1

burst time: [5, -1, 3, 13, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 13

process: p8

burst time: [4, -10, 5, 8, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 8

process: p6

burst time: [11, -4, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -6, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 44

process: p7

burst time: [14, 37, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 37

process: p4

burst time: [3, -2, 4, 15, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 15

process: p1

burst time: [5, -1, 3, 8, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 8

process: p8

burst time: [4, -10, 5, 3, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 3

process: p6

burst time: [11, -4, 4, 3, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p1

p8

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 41

process: p2

burst time: [4, -6, 5, 32, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 32

process: p7

burst time: [14, 25, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 25

process: p4

burst time: [3, -2, 4, 3, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p4

p8

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, 36, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 36

process: p2

burst time: [4, -6, 5, 27, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 27

process: p7

burst time: [14, 20, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 20

process: p6

burst time: [11, -4, 4, -9, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 10

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p8

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p1

burst time: [5, -1, 3, -4, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 43

process: p3

burst time: [8, -4, 12, 31, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 31

process: p2

burst time: [4, -6, 5, 22, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 22

process: p7

burst time: [14, 15, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 15

process: p6

burst time: [11, -4, 4, -9, 5, 5, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p6

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -2, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 45

process: p1

burst time: [5, -1, 3, -4, 5, 38, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 38

process: p3

burst time: [8, -4, 12, 26, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 26

process: p2

burst time: [4, -6, 5, 17, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 17

process: p7

burst time: [14, 10, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 10

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 51

process: p4

burst time: [3, -2, 4, -2, 5, 39, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 39

process: p1

burst time: [5, -1, 3, -4, 5, 32, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 32

process: p3

burst time: [8, -4, 12, 20, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 20

process: p2

burst time: [4, -6, 5, 11, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 11

process: p7

burst time: [14, 4, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 4

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, 45, 14, 73, 16, 87, 6]

time left in waiting: 45

process: p4

burst time: [3, -2, 4, -2, 5, 33, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 33

process: p1

burst time: [5, -1, 3, -4, 5, 26, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 26

process: p3

burst time: [8, -4, 12, 14, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 14

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 12

process: p2

burst time: [4, -6, 5, 5, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p6

p7

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, 29, 14, 73, 16, 87, 6]

time left in waiting: 29

process: p5

burst time: [16, 24, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 24

process: p4

burst time: [3, -2, 4, -2, 5, 17, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 17

process: p1

burst time: [5, -1, 3, -4, 5, 10, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 10

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p7

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -6, 5, -11, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 42

process: p8

burst time: [4, -10, 5, -9, 6, 22, 14, 73, 16, 87, 6]

time left in waiting: 22

process: p5

burst time: [16, 17, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 17

process: p4

burst time: [3, -2, 4, -2, 5, 10, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 10

process: p1

burst time: [5, -1, 3, -4, 5, 3, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p7

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -6, 5, -11, 7, 35, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 35

process: p8

burst time: [4, -10, 5, -9, 6, 15, 14, 73, 16, 87, 6]

time left in waiting: 15

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 14

process: p5

burst time: [16, 10, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 10

process: p4

burst time: [3, -2, 4, -2, 5, 3, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p7

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -6, 5, -11, 7, 31, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 31

process: p1

burst time: [5, -1, 3, -4, 5, -4, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 18

process: p8

burst time: [4, -10, 5, -9, 6, 11, 14, 73, 16, 87, 6]

time left in waiting: 11

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, 10, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 10

process: p5

burst time: [16, 6, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 6

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 51

process: p2

burst time: [4, -6, 5, -11, 7, 28, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 28

process: p1

burst time: [5, -1, 3, -4, 5, -4, 4, 15, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 15

process: p8

burst time: [4, -10, 5, -9, 6, 8, 14, 73, 16, 87, 6]

time left in waiting: 8

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, 7, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 7

process: p5

burst time: [16, 3, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p6

p8

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, -2, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 41

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, 34, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 34

process: p2

burst time: [4, -6, 5, -11, 7, 11, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 11

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p8

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, -2, 17, 35, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 35

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, 28, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 28

process: p1

burst time: [5, -1, 3, -4, 5, -4, 4, -2, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 22

process: p2

burst time: [4, -6, 5, -11, 7, 5, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p8

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, -2, 17, 26, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 26

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, 19, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 19

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, -10, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 18

process: p1

burst time: [5, -1, 3, -4, 5, -4, 4, -2, 6, 13, 4, 26, 3, 24, 4]

time left in waiting: 13

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 37

process: p7

burst time: [14, -2, 17, 14, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 14

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, 7, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 7

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, -10, 9, 6, 12, 24, 15, 30, 8]

time left in waiting: 6

process: p1

burst time: [5, -1, 3, -4, 5, -4, 4, -2, 6, 1, 4, 26, 3, 24, 4]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p4

p7

p6

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, 73, 16, 87, 6]

time left in waiting: 73

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, 23, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 23

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p7

p6

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, 69, 16, 87, 6]

time left in waiting: 69

process: p1

burst time: [5, -1, 3, -4, 5, -4, 4, -2, 6, -13, 4, 26, 3, 24, 4]

time left in waiting: 26

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, 19, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 19

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p6

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, 65, 16, 87, 6]

time left in waiting: 65

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 61

process: p1

burst time: [5, -1, 3, -4, 5, -4, 4, -2, 6, -13, 4, 22, 3, 24, 4]

time left in waiting: 22

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, 15, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 15

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, 54, 16, 87, 6]

time left in waiting: 54

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, 50, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 50

process: p7

burst time: [14, -2, 17, 0, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 42

process: p1

burst time: [5, -1, 3, -4, 5, -4, 4, -2, 6, -13, 4, 11, 3, 24, 4]

time left in waiting: 11

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, 4, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 4

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p2

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, 42, 16, 87, 6]

time left in waiting: 42

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, 38, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 38

process: p7

burst time: [14, -2, 17, 0, 11, 30, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 30

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, -10, 9, -8, 12, 24, 15, 30, 8]

time left in waiting: 24

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, 39, 16, 87, 6]

time left in waiting: 39

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, 35, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 35

process: p7

burst time: [14, -2, 17, 0, 11, 27, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 27

process: p1

burst time: [5, -1, 3, -4, 5, -4, 4, -2, 6, -13, 4, -1, 3, 24, 4]

time left in waiting: 24

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, -10, 9, -8, 12, 21, 15, 30, 8]

time left in waiting: 21

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 76

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, 30, 16, 87, 6]

time left in waiting: 30

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, 26, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 26

process: p7

burst time: [14, -2, 17, 0, 11, 18, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 18

process: p1

burst time: [5, -1, 3, -4, 5, -4, 4, -2, 6, -13, 4, -1, 3, 15, 4]

time left in waiting: 15

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, -10, 9, -8, 12, 12, 15, 30, 8]

time left in waiting: 12

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p6

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, 59, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 59

process: p5

burst time: [16, -14, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 21

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, 13, 16, 87, 6]

time left in waiting: 13

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, 9, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 9

process: p7

burst time: [14, -2, 17, 0, 11, 1, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p7

p8

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, 40, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 40

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, -10, 9, -8, 12, -5, 15, 30, 8]

time left in waiting: 30

process: p5

burst time: [16, -14, 17, 2, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 2

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p7

p8

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 54

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, 35, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 35

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, -10, 9, -8, 12, -5, 15, 25, 8]

time left in waiting: 25

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p8

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, 49, 6, 82, 5, 77, 3]

time left in waiting: 49

process: p5

burst time: [16, -14, 17, -3, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 36

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, 30, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 30

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, -10, 9, -8, 12, -5, 15, 20, 8]

time left in waiting: 20

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, 34, 6, 82, 5, 77, 3]

time left in waiting: 34

process: p5

burst time: [16, -14, 17, -3, 5, 21, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 21

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 21

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, 15, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 15

process: p6

burst time: [11, -4, 4, -9, 5, 0, 6, -4, 7, -10, 9, -8, 12, -5, 15, 5, 8]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p6

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, -6, 16, 87, 6]

time left in waiting: 87

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, 18, 6, 82, 5, 77, 3]

time left in waiting: 18

process: p5

burst time: [16, -14, 17, -3, 5, 5, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 5

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, 5, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, -6, 16, 83, 6]

time left in waiting: 83

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, -1, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 41

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, 14, 6, 82, 5, 77, 3]

time left in waiting: 14

process: p5

burst time: [16, -14, 17, -3, 5, 1, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 1

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, 1, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, -6, 16, 71, 6]

time left in waiting: 71

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, -7, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 32

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, -1, 4, 29, 9, 31, 7, 43, 8]

time left in waiting: 29

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, 2, 6, 82, 5, 77, 3]

time left in waiting: 2

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, -6, 16, 55, 6]

time left in waiting: 55

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 26

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, -7, 4, 16, 7, 19, 16, 33, 10]

time left in waiting: 16

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, -1, 4, 13, 9, 31, 7, 43, 8]

time left in waiting: 13

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, 82, 5, 77, 3]

time left in waiting: 82

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, -6, 16, 49, 6]

time left in waiting: 49

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, 20, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 20

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, -7, 4, 10, 7, 19, 16, 33, 10]

time left in waiting: 10

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, -1, 4, 7, 9, 31, 7, 43, 8]

time left in waiting: 7

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, -2, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 65

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, 64, 5, 77, 3]

time left in waiting: 64

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, -6, 16, 31, 6]

time left in waiting: 31

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, 2, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 2

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, -2, 18, 58, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 58

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, 57, 5, 77, 3]

time left in waiting: 57

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, -6, 16, 24, 6]

time left in waiting: 24

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, -7, 4, -8, 7, 19, 16, 33, 10]

time left in waiting: 19

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, -2, 18, 51, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 51

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, 50, 5, 77, 3]

time left in waiting: 50

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, -5, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 31

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, -6, 16, 17, 6]

time left in waiting: 17

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, -7, 4, -8, 7, 12, 16, 33, 10]

time left in waiting: 12

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, -2, 18, 42, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 42

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, 41, 5, 77, 3]

time left in waiting: 41

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, -1, 4, -11, 9, 31, 7, 43, 8]

time left in waiting: 31

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, -5, 7, 22, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 22

process: p8

burst time: [4, -10, 5, -9, 6, -9, 14, -6, 16, 8, 6]

time left in waiting: 8

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, -7, 4, -8, 7, 3, 16, 33, 10]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, -7, 4, -8, 7, 0, 16, 33, 10]

time left in waiting: 33

process: p3

burst time: [8, -4, 12, -2, 18, 23, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 23

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, 22, 5, 77, 3]

time left in waiting: 22

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, -1, 4, -11, 9, 12, 7, 43, 8]

time left in waiting: 12

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, -5, 7, 3, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, -5, 7, -3, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 28

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, -7, 4, -8, 7, 0, 16, 14, 10]

time left in waiting: 14

process: p3

burst time: [8, -4, 12, -2, 18, 4, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 4

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, 3, 5, 77, 3]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, -1, 4, -11, 9, -7, 7, 43, 8]

time left in waiting: 43

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, -5, 7, -3, 13, 21, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 21

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, -7, 4, -8, 7, 0, 16, 7, 10]

time left in waiting: 7

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, -4, 5, 77, 3]

time left in waiting: 77

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, -1, 4, -11, 9, -7, 7, 38, 8]

time left in waiting: 38

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, -5, 7, -3, 13, 16, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 16

process: p7

burst time: [14, -2, 17, 0, 11, -3, 15, -7, 4, -8, 7, 0, 16, 2, 10]

time left in waiting: 2

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, -4, 5, 63, 3]

time left in waiting: 63

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, -1, 4, -11, 9, -7, 7, 24, 8]

time left in waiting: 24

process: p3

burst time: [8, -4, 12, -2, 18, -3, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 21

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, -5, 7, -3, 13, 2, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 2

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, -4, 5, 42, 3]

time left in waiting: 42

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, -5, 7, -3, 13, -8, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 21

process: p2

burst time: [4, -6, 5, -11, 7, -4, 12, -8, 9, -1, 4, -11, 9, -7, 7, 3, 8]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, -2, 18, -3, 14, 0, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 61

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, -4, 5, 38, 3]

time left in waiting: 38

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, -5, 7, -3, 13, -8, 11, 17, 6, 13, 3, 11, 4]

time left in waiting: 17

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, -2, 18, -3, 14, 0, 4, 38, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 38

process: p4

burst time: [3, -2, 4, -2, 5, -1, 3, -7, 4, -10, 5, -14, 6, -4, 5, 15, 3]

time left in waiting: 15

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, -5, 7, -3, 13, -8, 11, 0, 6, 13, 3, 11, 4]

time left in waiting: 13

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, -2, 18, -3, 14, 0, 4, 22, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 22

process: p5

burst time: [16, -14, 17, -3, 5, -7, 16, -5, 7, -3, 13, -8, 11, 0, 6, 0, 3, 11, 4]

time left in waiting: 11

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, -2, 18, -3, 14, 0, 4, 0, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 18

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, -2, 18, -3, 14, 0, 4, 0, 15, 0, 14, 26, 5, 31, 6]

time left in waiting: 26

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [8, -4, 12, -2, 18, -3, 14, 0, 4, 0, 15, 0, 14, 0, 5, 31, 6]

time left in waiting: 31

END

total time: 668

cpu utilization %: 82.78443113772454

Average waiting time: 267.0

Average turn-around time: 469.625

Average response time: 27.125

process: p1

waiting time: 191

turn around time: 268

response time : 11

process: p6

waiting time: 138

turn around time: 336

response time : 24

process: p8

waiting time: 258

turn around time: 428

response time : 7

process: p7

waiting time: 234

turn around time: 477

response time : 47

process: p2

waiting time: 362

turn around time: 500

response time : 3

process: p4

waiting time: 446

turn around time: 534

response time : 0

process: p5

waiting time: 211

turn around time: 546

response time : 109

process: p3

waiting time: 296

turn around time: 668

response time : 16

MLFQ

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p3

p4

p5

p6

p7

p8

END

waiting is empty

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p4

p5

p6

p7

p8

END

waiting is empty

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p6

p7

p8

p3

END

waiting is empty

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p5

p6

p7

END

waiting is empty

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p6

p7

END

waiting is empty

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p5

END

waiting is empty

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

END

waiting is empty

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

waiting is empty

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p4

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [4, 42, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 42

process: p5

burst time: [1, 21, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 21

process: p6

burst time: [1, 14, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 14

process: p3

burst time: [3, 4, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 4

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p2

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [4, 37, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 37

process: p5

burst time: [1, 16, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 16

process: p6

burst time: [1, 9, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 9

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [4, 33, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 33

process: p5

burst time: [1, 12, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 12

process: p6

burst time: [1, 5, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [4, 28, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 28

process: p5

burst time: [1, 7, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 7

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [4, 14, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 14

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [4, 12, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 12

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

END

waiting is empty

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

waiting is empty

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p8

p4

p2

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p1

burst time: [5, 0, 3, -9, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 43

process: p7

burst time: [4, -5, 7, 36, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 36

process: p3

burst time: [3, -1, 2, 2, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 2

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p4

p2

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p1

burst time: [5, 0, 3, -9, 5, 38, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 38

process: p7

burst time: [4, -5, 7, 31, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 31

process: p6

burst time: [1, 0, 4, -4, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 10

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p2

p5

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, 51, 14, 73, 16, 87, 6]

time left in waiting: 51

process: p1

burst time: [5, 0, 3, -9, 5, 32, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 32

process: p7

burst time: [4, -5, 7, 25, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 25

process: p6

burst time: [1, 0, 4, -4, 5, 4, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 4

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p5

p3

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, 46, 14, 73, 16, 87, 6]

time left in waiting: 46

process: p4

burst time: [3, -2, 4, -7, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 45

process: p1

burst time: [5, 0, 3, -9, 5, 27, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 27

process: p7

burst time: [4, -5, 7, 20, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 20

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p3

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -2, 5, -6, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 42

process: p8

burst time: [4, -4, 5, -2, 6, 39, 14, 73, 16, 87, 6]

time left in waiting: 39

process: p4

burst time: [3, -2, 4, -7, 5, 38, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 38

process: p1

burst time: [5, 0, 3, -9, 5, 20, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 20

process: p7

burst time: [4, -5, 7, 13, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 13

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -2, 5, -6, 7, 37, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 37

process: p5

burst time: [1, -3, 7, -1, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 36

process: p8

burst time: [4, -4, 5, -2, 6, 34, 14, 73, 16, 87, 6]

time left in waiting: 34

process: p4

burst time: [3, -2, 4, -7, 5, 33, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 33

process: p1

burst time: [5, 0, 3, -9, 5, 15, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 15

process: p7

burst time: [4, -5, 7, 8, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p7

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [3, -1, 2, -3, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 65

process: p2

burst time: [4, -2, 5, -6, 7, 19, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 19

process: p5

burst time: [1, -3, 7, -1, 5, 18, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 18

process: p8

burst time: [4, -4, 5, -2, 6, 16, 14, 73, 16, 87, 6]

time left in waiting: 16

process: p4

burst time: [3, -2, 4, -7, 5, 15, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 15

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [3, -1, 2, -3, 18, 59, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 59

process: p2

burst time: [4, -2, 5, -6, 7, 13, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 13

process: p5

burst time: [1, -3, 7, -1, 5, 12, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 12

process: p6

burst time: [1, 0, 4, -4, 5, -1, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 12

process: p8

burst time: [4, -4, 5, -2, 6, 10, 14, 73, 16, 87, 6]

time left in waiting: 10

process: p4

burst time: [3, -2, 4, -7, 5, 9, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 9

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p4

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [3, -1, 2, -3, 18, 48, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 48

process: p7

burst time: [4, -5, 7, -10, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 42

process: p2

burst time: [4, -2, 5, -6, 7, 2, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 2

process: p5

burst time: [1, -3, 7, -1, 5, 1, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 1

process: p6

burst time: [1, 0, 4, -4, 5, -1, 6, 1, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p8

p6

p5

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [3, -1, 2, -3, 18, 44, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 44

process: p7

burst time: [4, -5, 7, -10, 11, 38, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 38

process: p1

burst time: [5, 0, 3, -9, 5, -3, 4, 18, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 18

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p6

p5

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 51

process: p3

burst time: [3, -1, 2, -3, 18, 41, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 41

process: p7

burst time: [4, -5, 7, -10, 11, 35, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 35

process: p1

burst time: [5, 0, 3, -9, 5, -3, 4, 15, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 15

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p5

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, 73, 16, 87, 6]

time left in waiting: 73

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, 37, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 37

process: p3

burst time: [3, -1, 2, -3, 18, 27, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 27

process: p7

burst time: [4, -5, 7, -10, 11, 21, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 21

process: p1

burst time: [5, 0, 3, -9, 5, -3, 4, 1, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p2

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, 66, 16, 87, 6]

time left in waiting: 66

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, 30, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 30

process: p3

burst time: [3, -1, 2, -3, 18, 20, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 20

process: p7

burst time: [4, -5, 7, -10, 11, 14, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 14

process: p6

burst time: [1, 0, 4, -4, 5, -1, 6, -3, 7, 14, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 14

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p1

p6

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, 50, 16, 87, 6]

time left in waiting: 50

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 26

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, 14, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 14

process: p3

burst time: [3, -1, 2, -3, 18, 4, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 4

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p6

p7

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, 38, 16, 87, 6]

time left in waiting: 38

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 37

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, 14, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 14

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, 2, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 2

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p7

p3

p4

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, 32, 16, 87, 6]

time left in waiting: 32

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, 31, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 31

process: p1

burst time: [5, 0, 3, -9, 5, -3, 4, -6, 6, 22, 4, 26, 3, 24, 4]

time left in waiting: 22

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, 8, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p3

p4

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, 23, 16, 87, 6]

time left in waiting: 23

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, 22, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 22

process: p6

burst time: [1, 0, 4, -4, 5, -1, 6, -3, 7, -2, 9, 18, 12, 24, 15, 30, 8]

time left in waiting: 18

process: p1

burst time: [5, 0, 3, -9, 5, -3, 4, -6, 6, 13, 4, 26, 3, 24, 4]

time left in waiting: 13

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p4

p5

p1

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, 21, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 21

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, 8, 16, 87, 6]

time left in waiting: 8

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, 7, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 7

process: p6

burst time: [1, 0, 4, -4, 5, -1, 6, -3, 7, -2, 9, 3, 12, 24, 15, 30, 8]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p5

p1

p6

p2

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 21

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, 7, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 7

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p1

p6

p2

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, 61, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 61

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, 17, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 17

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, 3, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p6

p2

p8

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, 54, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 54

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 31

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, 10, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 10

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p2

p8

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, 50, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 50

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, 27, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 27

process: p1

burst time: [5, 0, 3, -9, 5, -3, 4, -6, 6, -2, 4, 26, 3, 24, 4]

time left in waiting: 26

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, 6, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 6

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p8

p7

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, 38, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 38

process: p6

burst time: [1, 0, 4, -4, 5, -1, 6, -3, 7, -2, 9, -11, 12, 24, 15, 30, 8]

time left in waiting: 24

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, 15, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 15

process: p1

burst time: [5, 0, 3, -9, 5, -3, 4, -6, 6, -2, 4, 14, 3, 24, 4]

time left in waiting: 14

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p7

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, 76, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 76

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, 29, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 29

process: p6

burst time: [1, 0, 4, -4, 5, -1, 6, -3, 7, -2, 9, -11, 12, 15, 15, 30, 8]

time left in waiting: 15

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, 6, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 6

process: p1

burst time: [5, 0, 3, -9, 5, -3, 4, -6, 6, -2, 4, 5, 3, 24, 4]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p3

p1

p5

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, -6, 16, 87, 6]

time left in waiting: 87

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, 60, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 60

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, 13, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 13

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p1

p5

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, -6, 16, 83, 6]

time left in waiting: 83

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, 56, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 56

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, -4, 4, 32, 7, 19, 16, 33, 10]

time left in waiting: 32

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, 9, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 9

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p5

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, -6, 16, 79, 6]

time left in waiting: 79

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, 61, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 61

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, 52, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 52

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, -4, 4, 28, 7, 19, 16, 33, 10]

time left in waiting: 28

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, 5, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p6

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, -6, 16, 76, 6]

time left in waiting: 76

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, 58, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 58

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, 49, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 49

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, -4, 4, 25, 7, 19, 16, 33, 10]

time left in waiting: 25

process: p1

burst time: [5, 0, 3, -9, 5, -3, 4, -6, 6, -2, 4, -11, 3, 24, 4]

time left in waiting: 24

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, 2, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 2

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p4

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, -6, 16, 63, 6]

time left in waiting: 63

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, 45, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 45

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, 36, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 36

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, -10, 13, 28, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 28

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, -4, 4, 12, 7, 19, 16, 33, 10]

time left in waiting: 12

process: p1

burst time: [5, 0, 3, -9, 5, -3, 4, -6, 6, -2, 4, -11, 3, 11, 4]

time left in waiting: 11

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p4

p1

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, -6, 16, 48, 6]

time left in waiting: 48

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, 30, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 30

process: p6

burst time: [1, 0, 4, -4, 5, -1, 6, -3, 7, -2, 9, -11, 12, -1, 15, 30, 8]

time left in waiting: 30

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, 21, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 21

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, -10, 13, 13, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 13

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p1

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, 54, 6, 82, 5, 77, 3]

time left in waiting: 54

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, -6, 16, 43, 6]

time left in waiting: 43

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, 25, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 25

process: p6

burst time: [1, 0, 4, -4, 5, -1, 6, -3, 7, -2, 9, -11, 12, -1, 15, 25, 8]

time left in waiting: 25

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, 16, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 16

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, -10, 13, 8, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, 43, 6, 82, 5, 77, 3]

time left in waiting: 43

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, -6, 16, 32, 6]

time left in waiting: 32

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, -4, 4, -3, 7, 19, 16, 33, 10]

time left in waiting: 19

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, 14, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 14

process: p6

burst time: [1, 0, 4, -4, 5, -1, 6, -3, 7, -2, 9, -11, 12, -1, 15, 14, 8]

time left in waiting: 14

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, 5, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, 32, 6, 82, 5, 77, 3]

time left in waiting: 32

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, -6, 16, 21, 6]

time left in waiting: 21

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, -10, 13, -3, 11, 21, 6, 13, 3, 11, 4]

time left in waiting: 21

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, -4, 4, -3, 7, 8, 16, 33, 10]

time left in waiting: 8

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, 3, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 3

process: p6

burst time: [1, 0, 4, -4, 5, -1, 6, -3, 7, -2, 9, -11, 12, -1, 15, 3, 8]

time left in waiting: 3

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p6

p3

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, -6, 4, 41, 9, 31, 7, 43, 8]

time left in waiting: 41

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, 28, 6, 82, 5, 77, 3]

time left in waiting: 28

process: p8

burst time: [4, -4, 5, -2, 6, -1, 14, -6, 16, 17, 6]

time left in waiting: 17

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, -10, 13, -3, 11, 17, 6, 13, 3, 11, 4]

time left in waiting: 17

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, -4, 4, -3, 7, 4, 16, 33, 10]

time left in waiting: 4

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

p5

p8

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, -6, 4, 18, 9, 31, 7, 43, 8]

time left in waiting: 18

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, -1, 15, 18, 14, 26, 5, 31, 6]

time left in waiting: 18

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, 5, 6, 82, 5, 77, 3]

time left in waiting: 5

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p8

p4

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, -4, 4, -3, 7, -4, 16, 33, 10]

time left in waiting: 33

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, -6, 4, 2, 9, 31, 7, 43, 8]

time left in waiting: 2

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, -1, 15, 2, 14, 26, 5, 31, 6]

time left in waiting: 2

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p8

p4

p3

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, -4, 4, -3, 7, -4, 16, 27, 10]

time left in waiting: 27

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, -10, 13, -3, 11, -6, 6, 13, 3, 11, 4]

time left in waiting: 13

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p3

p2

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, -11, 6, 82, 5, 77, 3]

time left in waiting: 82

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, -4, 4, -3, 7, -4, 16, 15, 10]

time left in waiting: 15

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, -10, 13, -3, 11, -6, 6, 1, 3, 11, 4]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p2

p5

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, -11, 6, 68, 5, 77, 3]

time left in waiting: 68

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, -1, 15, -4, 14, 26, 5, 31, 6]

time left in waiting: 26

process: p7

burst time: [4, -5, 7, -10, 11, -2, 15, -4, 4, -3, 7, -4, 16, 1, 10]

time left in waiting: 1

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p5

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, -11, 6, 59, 5, 77, 3]

time left in waiting: 59

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, -6, 4, -4, 9, 31, 7, 43, 8]

time left in waiting: 31

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, -1, 15, -4, 14, 17, 5, 31, 6]

time left in waiting: 17

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

p7

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, -11, 6, 56, 5, 77, 3]

time left in waiting: 56

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, -6, 4, -4, 9, 28, 7, 43, 8]

time left in waiting: 28

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, -1, 15, -4, 14, 14, 5, 31, 6]

time left in waiting: 14

process: p5

burst time: [1, -3, 7, -1, 5, -3, 16, -1, 7, -10, 13, -3, 11, -6, 6, -13, 3, 11, 4]

time left in waiting: 11

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, -11, 6, 36, 5, 77, 3]

time left in waiting: 36

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, -1, 15, -4, 14, -1, 5, 31, 6]

time left in waiting: 31

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, -6, 4, -4, 9, 8, 7, 43, 8]

time left in waiting: 8

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, -6, 4, -4, 9, 0, 7, 43, 8]

time left in waiting: 43

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, -11, 6, 21, 5, 77, 3]

time left in waiting: 21

process: p3

burst time: [3, -1, 2, -3, 18, -8, 14, -6, 4, -1, 15, -4, 14, -1, 5, 16, 6]

time left in waiting: 16

END

\_\_\_\_\_\_\_\_\_ready queue\_\_\_\_\_\_\_\_\_\_

END

\_\_\_\_\_\_\_\_\_\_\_\_waiting\_\_\_\_\_\_\_\_\_\_

process: p4

burst time: [3, -2, 4, -7, 5, -2, 3, -4, 4, -11, 5, -11, 6, -1, 5, 77, 3]

time left in waiting: 77

process: p2

burst time: [4, -2, 5, -6, 7, -2, 12, -7, 9, -6, 4, -4, 9, 0, 7, 16, 8]

time left in waiting: 16

END

total time: 647

cpu utilization %: 85.47140649149922

Average waiting time: 267.0

Average turn-around time: 517.25

Average response time: 15.75

process: p1

waiting time: 191

turn around time: 400

response time : 0

process: p6

waiting time: 138

turn around time: 430

response time : 22

process: p8

waiting time: 258

turn around time: 473

response time : 32

process: p7

waiting time: 234

turn around time: 515

response time : 27

process: p5

waiting time: 211

turn around time: 520

response time : 17

process: p3

waiting time: 296

turn around time: 562

response time : 9

process: p2

waiting time: 362

turn around time: 591

response time : 5

process: p4

waiting time: 446

turn around time: 647

response time : 14

# Tables

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **SJF CPU UTIL: 82.78%** | | | | **FCFS CPU UTIL: 84.55%** | | | | **MLFQ CPU UTIL: 85.47%** | | | |
|  | ***Tw*** | ***Ttr*** | ***Tr*** |  | ***Tw*** | ***Ttr*** | ***Tr*** |  | ***Tw*** | ***Ttr*** | ***Tr*** |  |
| P1 | 191 | 268 | 11 | 191 | 395 | 0 | 191 | 400 | 0 |
| P2 | 362 | 500 | 3 | 362 | 591 | 5 | 362 | 591 | 5 |
| P3 | 296 | 668 | 16 | 296 | 557 | 9 | 296 | 562 | 9 |
| P4 | 446 | 534 | 0 | 446 | 648 | 17 | 446 | 647 | 14 |
| P5 | 211 | 546 | 109 | 211 | 530 | 20 | 211 | 520 | 17 |
| P6 | 138 | 336 | 24 | 138 | 445 | 36 | 138 | 430 | 22 |
| P7 | 234 | 477 | 47 | 234 | 512 | 47 | 234 | 515 | 27 |
| P8 | 258 | 428 | 7 | 258 | 493 | 61 | 258 | 473 | 32 |
| **Avg** | ***267*** | ***469.63*** | ***27.13*** | ***267*** | ***521.37*** | ***24.37*** | ***267*** | ***517.25*** | ***15.75*** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **SJF** | **FCFS** | **MLFQ** |
| CPU utilization | 82.78% | 84.55% | 85.47% |
| Avg Waiting time (Tw) | 267 | 267 | 267 |
| Avg Turnaround time (Ttr) | 469.625 | 521.37 | 517.25 |
| Avg Response time (Tr) | 27.125 | 24.37 | 15.75 |