HW2: Process Scheduling Algorithms

Team 7

Jonathan Weinstein 009789039

…

We implemented this assignment using C++11, though most of the code can pass as plain C.

To run our program using GCC or compatible compiler, place all source and header files in the same directory and issue:

g++ -std=c++11 -Wall -Wextra \*.cpp

All 6 of the required algorithms are completed, as well as the two extra-credit (Aging variants of HPF, both preemptive/not) for a total of 8.

There is test function that verifies the frequency of time slices and a jobs total burst. Algorithm outputs were also examined and checked against edge cases.

The structure of main is an outermost loop that iterates for each algorithm, stored in a function pointer. All algorithms have the same signature. It is important to note that each algorithm runs on 5 data sets, before moving onto the next algorithm. The random number generator is reseeded to the same value before test 0 of each algorithm, so all algorithms work on the same data.

The algorithm signature contains an output array of

struct PerJobStats

**{**

int qbegin**,** qend**;**

**};**

Indexed by job ID. qbegin is the quanta when the job got its first time slice, and qend is when it finished (note this range is exclusive, see stats below). This schema makes the implementation of each algorithm simpler, instead of them all computing the 3 stats. These stats are computed after the algorithm runs, before they are printed on the same line.

int const response **=** stats**[**i**].**qbegin **-** job**[**i**].**arrival**;**

int const turnaround **=** stats**[**i**].**qend **-** job**[**i**].**arrival**;**

int const wait **=** turnaround **-** job**[**i**].**burst**;**

Jonathan observed that SJF, HPF(no preempt), and HPF-Aging(non-preempt) are all very similar to implement (same for their preemptive versions). They store pending jobs in a collection, ordered by some heuristic. They take the front most job and run it.

The ordering of the collection based on a comparison on an integer field. The only thing different is the field compared on!

SJF compares on remaining burst time.

HPF compares on priority.

HPF-Aging also compares on "priority," but I slyly store (initial\_priority\*5 + arrival time) in that field. Only a jobs priority relative to another is of interest.

(promoted 1 priority every 5 secs, and + because lower priority value more important)

So I knocked out all three with the following template function, which allows for a different comparison function (or C++ ‘functor’) and what data to insert when inserting a job into the collection (the Aging parameter).

dat**.**priority **=** aging **?** jb**.**priority**\***5u **+** jb**.**arrival **:** jb**.**priority**;**

template**<**class CmpFunc**,** bool Aging**=false>**

AlgoRet non\_preempt**(**const Job **\***job**,** int njobs**,** PerJobStats **\***stats**,** char **\***gantt**);**

For example, SJF is:

non\_preempt**<**SrtComp**,** **false>**

**Stat results and analysis:**

The tail of this document contains the program output. Once again, an algorithm runs on each data set (test 0 to 4) before moving to the next algorithm. Wait time, turnaround, and response are displayed after each test. So is a gantt chart, showing the ID of what process ran during that quanta, ‘.’ Indicates the cpu was idle. After all 5 tests run, averages are displayed, and the next algorithm begins.

Analysis:

First Come First Serve is simple to implement with few context switches. Wait times can very a lot due to high burst time processes clogging the queue, making it unsuitable for a user-device. However, globally it may be a good choice in situations where wait time is not an issue.

Shortest Job First and Shortest Remaining Time both have very optimized performance across the board. For our simulation purposes, these

algorithms would be the best. However, these two rely on the CPU having prior knowledge of the burst times of the processes they are

supposed to service. Therefore, these two algorithms have limited application.

Round Robin has the most optimized response time because time is evenly distributed between the processes, giving all of them

a chance to run making it an excellent choice for a user-device. It is somewhat complicated to implement, especially as a ‘true’ round robin, and its many context switches would make it a poor choice globally and not suitable for a database.

Although the Priority Algorithms seem to perform poorly, their advantage is not captured through this simulation due to all processes

getting assigned random priorities. Presumably in the real world, processes with higher priorities are more important. These leads

to cases of inefficiency if a high priority process has a large burst time that clogs up the priority queue. This problem is fixed

by adding aging, which raises the priority of processes that have not been serviced in a long time. Aging appears to improve performance

of priority algorithms in all respects.

Seed: 0xCAFEBEEF, Number of tests: 5

\*\*\* Testing algorithm: First Come First Serve \*\*\*

Test no: 0

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 2 : 0 0 16

B 13 5 4 : 3 3 8

C 17 13 4 : 4 4 17

D 31 9 3 : 3 3 12

E 38 4 4 : 5 5 9

F 39 12 1 : 8 8 20

G 53 14 1 : 6 6 20

H 68 8 1 : 5 5 13

I 75 13 4 : 6 6 19

J 81 5 2 : 13 13 18

K 86 5 4 : 13 13 18

L 93 14 2 : ~ ~ ~

M 106 3 2 : ~ ~ ~

N 107 15 4 : ~ ~ ~

Average wait : 66/11 = 6.000

Average response : 66/11 = 6.000

Average turnaround : 170/11 = 15.455

Throughput: 11/104 = 0.105769 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAABBBBBCCCCCCCCCCCCCDDDDDDDDDEEEEFFFFFFFFFFFFGGGGGGGGGGGGGGHHHHHHHHIIIIIIIIIIIIIJJJJJKKKKK

Test no: 1

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 3 : 0 0 16

B 17 3 4 : 0 0 3

C 22 8 2 : 0 0 8

D 28 11 4 : 2 2 13

E 36 9 3 : 5 5 14

F 39 16 4 : 11 11 27

G 55 5 2 : 11 11 16

H 62 12 2 : 9 9 21

I 68 13 3 : 15 15 28

J 82 9 2 : 14 14 23

K 83 15 1 : ~ ~ ~

L 90 10 4 : ~ ~ ~

M 98 5 4 : ~ ~ ~

N 100 5 2 : ~ ~ ~

Average wait : 67/10 = 6.700

Average response : 67/10 = 6.700

Average turnaround : 169/10 = 16.900

Throughput: 10/105 = 0.095238 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAA.BBB..CCCCCCCCDDDDDDDDDDDEEEEEEEEEFFFFFFFFFFFFFFFFGGGGGHHHHHHHHHHHHIIIIIIIIIIIIIJJJJJJJJJ

Test no: 2

ID Arrival Burst Priority : Response Wait Turnaround

A 0 8 3 : 0 0 8

B 8 6 3 : 0 0 6

C 9 13 1 : 5 5 18

D 24 6 4 : 3 3 9

E 32 9 3 : 1 1 10

F 42 15 2 : 0 0 15

G 43 5 1 : 14 14 19

H 49 9 1 : 13 13 22

I 54 9 4 : 17 17 26

J 62 8 4 : 18 18 26

K 66 8 2 : 22 22 30

L 72 11 1 : 24 24 35

M 80 9 4 : ~ ~ ~

N 86 14 3 : ~ ~ ~

Average wait : 117/12 = 9.750

Average response : 117/12 = 9.750

Average turnaround : 224/12 = 18.667

Throughput: 12/107 = 0.112150 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAABBBBBBCCCCCCCCCCCCCDDDDDDEEEEEEEEEFFFFFFFFFFFFFFFGGGGGHHHHHHHHHIIIIIIIIIJJJJJJJJKKKKKKKKLLLLLLLLLLL

Test no: 3

ID Arrival Burst Priority : Response Wait Turnaround

A 0 7 4 : 0 0 7

B 9 3 3 : 0 0 3

C 13 6 2 : 0 0 6

D 15 13 1 : 4 4 17

E 21 7 4 : 11 11 18

F 29 11 3 : 10 10 21

G 31 9 3 : 19 19 28

H 40 14 4 : 19 19 33

I 56 9 3 : 17 17 26

J 61 16 2 : 21 21 37

K 63 7 1 : 35 35 42

L 65 13 4 : ~ ~ ~

M 73 4 2 : ~ ~ ~

N 77 4 3 : ~ ~ ~

Average wait : 136/11 = 12.364

Average response : 136/11 = 12.364

Average turnaround : 238/11 = 21.636

Throughput: 11/105 = 0.104762 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAA..BBB.CCCCCCDDDDDDDDDDDDDEEEEEEEFFFFFFFFFFFGGGGGGGGGHHHHHHHHHHHHHHIIIIIIIIIJJJJJJJJJJJJJJJJKKKKKKK

Test no: 4

ID Arrival Burst Priority : Response Wait Turnaround

A 0 9 3 : 0 0 9

B 4 16 1 : 5 5 21

C 15 4 2 : 10 10 14

D 21 7 3 : 8 8 15

E 25 8 4 : 11 11 19

F 29 6 3 : 15 15 21

G 32 13 4 : 18 18 31

H 35 13 1 : 28 28 41

I 43 6 2 : 33 33 39

J 45 7 3 : 37 37 44

K 49 10 2 : 40 40 50

L 57 11 2 : 42 42 53

M 60 15 4 : ~ ~ ~

N 73 12 2 : ~ ~ ~

Average wait : 247/12 = 20.583

Average response : 247/12 = 20.583

Average turnaround : 357/12 = 29.750

Throughput: 12/110 = 0.109091 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAABBBBBBBBBBBBBBBBCCCCDDDDDDDEEEEEEEEFFFFFFGGGGGGGGGGGGGHHHHHHHHHHHHHIIIIIIJJJJJJJKKKKKKKKKKLLLLLLLLLLL

All 5 tests for [First Come First Serve] done, averages:

Wait : 11.079

Response : 11.079

Turnaround: 20.482

Throughput: 10.540 per 100 quanta

\*\*\* Testing algorithm: Shortest Job First (non-preemptive) \*\*\*

Test no: 0

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 2 : 0 0 16

B 13 5 4 : 3 3 8

C 17 13 4 : 4 4 17

D 31 9 3 : 3 3 12

E 38 4 4 : 5 5 9

F 39 12 1 : 8 8 20

G 53 14 1 : 6 6 20

H 68 8 1 : 5 5 13

I 75 13 4 : 16 16 29

J 81 5 2 : 0 0 5

K 86 5 4 : 0 0 5

L 93 14 2 : ~ ~ ~

M 106 3 2 : ~ ~ ~

N 107 15 4 : ~ ~ ~

Average wait : 50/11 = 4.545

Average response : 50/11 = 4.545

Average turnaround : 154/11 = 14.000

Throughput: 11/104 = 0.105769 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAABBBBBCCCCCCCCCCCCCDDDDDDDDDEEEEFFFFFFFFFFFFGGGGGGGGGGGGGGHHHHHHHHJJJJJKKKKKIIIIIIIIIIIII

Test no: 1

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 3 : 0 0 16

B 17 3 4 : 0 0 3

C 22 8 2 : 0 0 8

D 28 11 4 : 2 2 13

E 36 9 3 : 5 5 14

F 39 16 4 : 11 11 27

G 55 5 2 : 11 11 16

H 62 12 2 : 9 9 21

I 68 13 3 : ~ ~ ~

J 82 9 2 : 1 1 10

K 83 15 1 : ~ ~ ~

L 90 10 4 : 2 2 12

M 98 5 4 : ~ ~ ~

N 100 5 2 : ~ ~ ~

Average wait : 41/10 = 4.100

Average response : 41/10 = 4.100

Average turnaround : 140/10 = 14.000

Throughput: 10/102 = 0.098039 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAA.BBB..CCCCCCCCDDDDDDDDDDDEEEEEEEEEFFFFFFFFFFFFFFFFGGGGGHHHHHHHHHHHHJJJJJJJJJLLLLLLLLLL

Test no: 2

ID Arrival Burst Priority : Response Wait Turnaround

A 0 8 3 : 0 0 8

B 8 6 3 : 0 0 6

C 9 13 1 : 5 5 18

D 24 6 4 : 3 3 9

E 32 9 3 : 1 1 10

F 42 15 2 : 0 0 15

G 43 5 1 : 14 14 19

H 49 9 1 : 29 29 38

I 54 9 4 : 33 33 42

J 62 8 4 : 0 0 8

K 66 8 2 : 4 4 12

L 72 11 1 : ~ ~ ~

M 80 9 4 : 16 16 25

N 86 14 3 : ~ ~ ~

Average wait : 105/12 = 8.750

Average response : 105/12 = 8.750

Average turnaround : 210/12 = 17.500

Throughput: 12/105 = 0.114286 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAABBBBBBCCCCCCCCCCCCCDDDDDDEEEEEEEEEFFFFFFFFFFFFFFFGGGGGJJJJJJJJKKKKKKKKHHHHHHHHHIIIIIIIIIMMMMMMMMM

Test no: 3

ID Arrival Burst Priority : Response Wait Turnaround

A 0 7 4 : 0 0 7

B 9 3 3 : 0 0 3

C 13 6 2 : 0 0 6

D 15 13 1 : 4 4 17

E 21 7 4 : 11 11 18

F 29 11 3 : 19 19 30

G 31 9 3 : 8 8 17

H 40 14 4 : 56 56 70

I 56 9 3 : 3 3 12

J 61 16 2 : ~ ~ ~

K 63 7 1 : 5 5 12

L 65 13 4 : 18 18 31

M 73 4 2 : 2 2 6

N 77 4 3 : 2 2 6

Average wait : 128/13 = 9.846

Average response : 128/13 = 9.846

Average turnaround : 235/13 = 18.077

Throughput: 13/110 = 0.118182 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAA..BBB.CCCCCCDDDDDDDDDDDDDEEEEEEEGGGGGGGGGFFFFFFFFFFFIIIIIIIIIKKKKKKKMMMMNNNNLLLLLLLLLLLLLHHHHHHHHHHHHHH

Test no: 4

ID Arrival Burst Priority : Response Wait Turnaround

A 0 9 3 : 0 0 9

B 4 16 1 : 5 5 21

C 15 4 2 : 10 10 14

D 21 7 3 : 14 14 21

E 25 8 4 : 17 17 25

F 29 6 3 : 0 0 6

G 32 13 4 : ~ ~ ~

H 35 13 1 : 61 61 74

I 43 6 2 : 7 7 13

J 45 7 3 : 11 11 18

K 49 10 2 : 14 14 24

L 57 11 2 : 16 16 27

M 60 15 4 : ~ ~ ~

N 73 12 2 : 11 11 23

Average wait : 166/12 = 13.833

Average response : 166/12 = 13.833

Average turnaround : 275/12 = 22.917

Throughput: 12/109 = 0.110092 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAABBBBBBBBBBBBBBBBCCCCFFFFFFDDDDDDDEEEEEEEEIIIIIIJJJJJJJKKKKKKKKKKLLLLLLLLLLLNNNNNNNNNNNNHHHHHHHHHHHHH

All 5 tests for [Shortest Job First (non-preemptive)] done, averages:

Wait : 8.215

Response : 8.215

Turnaround: 17.299

Throughput: 10.927 per 100 quanta

\*\*\* Testing algorithm: Shortest Remaining Time (preemptive) \*\*\*

Test no: 0

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 2 : 0 0 16

B 13 5 4 : 3 3 8

C 17 13 4 : 4 4 17

D 31 9 3 : 3 7 16

E 38 4 4 : 0 0 4

F 39 12 1 : 8 8 20

G 53 14 1 : 6 6 20

H 68 8 1 : 5 5 13

I 75 13 4 : 16 16 29

J 81 5 2 : 0 0 5

K 86 5 4 : 0 0 5

L 93 14 2 : 11 14 28

M 106 3 2 : 0 0 3

N 107 15 4 : ~ ~ ~

Average wait : 63/13 = 4.846

Average response : 56/13 = 4.308

Average turnaround : 184/13 = 14.154

Throughput: 13/121 = 0.107438 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAABBBBBCCCCCCCCCCCCCDDDDEEEEDDDDDFFFFFFFFFFFFGGGGGGGGGGGGGGHHHHHHHHJJJJJKKKKKIIIIIIIIIIIIILLMMMLLLLLLLLLLLL

Test no: 1

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 3 : 0 0 16

B 17 3 4 : 0 0 3

C 22 8 2 : 0 0 8

D 28 11 4 : 2 2 13

E 36 9 3 : 5 5 14

F 39 16 4 : 11 16 32

G 55 5 2 : 0 0 5

H 62 12 2 : 9 9 21

I 68 13 3 : ~ ~ ~

J 82 9 2 : 1 1 10

K 83 15 1 : ~ ~ ~

L 90 10 4 : 2 2 12

M 98 5 4 : ~ ~ ~

N 100 5 2 : ~ ~ ~

Average wait : 35/10 = 3.500

Average response : 30/10 = 3.000

Average turnaround : 134/10 = 13.400

Throughput: 10/102 = 0.098039 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAA.BBB..CCCCCCCCDDDDDDDDDDDEEEEEEEEEFFFFFGGGGGFFFFFFFFFFFHHHHHHHHHHHHJJJJJJJJJLLLLLLLLLL

Test no: 2

ID Arrival Burst Priority : Response Wait Turnaround

A 0 8 3 : 0 0 8

B 8 6 3 : 0 0 6

C 9 13 1 : 5 5 18

D 24 6 4 : 3 3 9

E 32 9 3 : 1 1 10

F 42 15 2 : 0 59 74

G 43 5 1 : 0 0 5

H 49 9 1 : 0 0 9

I 54 9 4 : 4 4 13

J 62 8 4 : 5 5 13

K 66 8 2 : 9 9 17

L 72 11 1 : 20 20 31

M 80 9 4 : 3 3 12

N 86 14 3 : ~ ~ ~

Average wait : 109/13 = 8.385

Average response : 50/13 = 3.846

Average turnaround : 225/13 = 17.308

Throughput: 13/116 = 0.112069 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAABBBBBBCCCCCCCCCCCCCDDDDDDEEEEEEEEEFGGGGGFHHHHHHHHHIIIIIIIIIJJJJJJJJKKKKKKKKMMMMMMMMMLLLLLLLLLLLFFFFFFFFFFFFF

Test no: 3

ID Arrival Burst Priority : Response Wait Turnaround

A 0 7 4 : 0 0 7

B 9 3 3 : 0 0 3

C 13 6 2 : 0 0 6

D 15 13 1 : 4 11 24

E 21 7 4 : 0 0 7

F 29 11 3 : 19 19 30

G 31 9 3 : 8 8 17

H 40 14 4 : 56 56 70

I 56 9 3 : 3 3 12

J 61 16 2 : ~ ~ ~

K 63 7 1 : 5 5 12

L 65 13 4 : 18 18 31

M 73 4 2 : 2 2 6

N 77 4 3 : 2 2 6

Average wait : 124/13 = 9.538

Average response : 117/13 = 9.000

Average turnaround : 231/13 = 17.769

Throughput: 13/110 = 0.118182 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAA..BBB.CCCCCCDDEEEEEEEDDDDDDDDDDDGGGGGGGGGFFFFFFFFFFFIIIIIIIIIKKKKKKKMMMMNNNNLLLLLLLLLLLLLHHHHHHHHHHHHHH

Test no: 4

ID Arrival Burst Priority : Response Wait Turnaround

A 0 9 3 : 0 0 9

B 4 16 1 : 5 22 38

C 15 4 2 : 0 0 4

D 21 7 3 : 0 0 7

E 25 8 4 : 17 23 31

F 29 6 3 : 0 0 6

G 32 13 4 : 64 64 77

H 35 13 1 : ~ ~ ~

I 43 6 2 : 0 0 6

J 45 7 3 : 11 11 18

K 49 10 2 : 14 14 24

L 57 11 2 : 16 16 27

M 60 15 4 : ~ ~ ~

N 73 12 2 : 11 11 23

Average wait : 161/12 = 13.417

Average response : 138/12 = 11.500

Average turnaround : 270/12 = 22.500

Throughput: 12/109 = 0.110092 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAABBBBBBCCCCBBDDDDDDDBFFFFFFBBBBBBBEIIIIIIEEEEEEEJJJJJJJKKKKKKKKKKLLLLLLLLLLLNNNNNNNNNNNNGGGGGGGGGGGGG

All 5 tests for [Shortest Remaining Time (preemptive)] done, averages:

Wait : 7.937

Response : 6.331

Turnaround: 17.026

Throughput: 10.916 per 100 quanta

\*\*\* Testing algorithm: Round Robin \*\*\*

Test no: 0

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 2 : 0 2 18

B 13 5 4 : 1 5 10

C 17 13 4 : 2 6 19

D 31 9 3 : 1 10 19

E 38 4 4 : 1 7 11

F 39 12 1 : 2 13 25

G 53 14 1 : 1 10 24

H 68 8 1 : 1 10 18

I 75 13 4 : 2 24 37

J 81 5 2 : 2 10 15

K 86 5 4 : 2 11 16

L 93 14 2 : 3 22 36

M 106 3 2 : 2 7 10

N 107 15 4 : 3 14 29

Average wait : 151/14 = 10.786

Average response : 23/14 = 1.643

Average turnaround : 287/14 = 20.500

Throughput: 14/136 = 0.102941 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAABABABCBCBCCCCCCCCCDCDCDDDEDFEDFEDFEDFFFFGFGFGFGFGFGGGGGHGHGHGHGIHIHIHJIHJIKJIKJIKJLIKLIKLILILIMLNIMLNMLNLNLNLNLNLNLNNNNNNN

Test no: 1

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 3 : 0 0 16

B 17 3 4 : 0 0 3

C 22 8 2 : 0 1 9

D 28 11 4 : 1 8 19

E 36 9 3 : 1 12 21

F 39 16 4 : 2 26 42

G 55 5 2 : 2 7 12

H 62 12 2 : 2 28 40

I 68 13 3 : 2 42 55

J 82 9 2 : 2 36 45

K 83 15 1 : 3 42 57

L 90 10 4 : 4 36 46

M 98 5 4 : 5 25 30

N 100 5 2 : 6 25 30

Average wait : 288/14 = 20.571

Average response : 30/14 = 2.143

Average turnaround : 425/14 = 30.357

Throughput: 14/140 = 0.100000 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAA.BBB..CCCCCCCDCDDDDDDEDEDFEDFEDFEFEFEFEFEGFGFGFGHFGHFHIFHIFHIFHIFHIHJIKHJIKHJILKHJILKHJMILNKJMILNKJMILNKJMILNKJMLNKLKLKLKKKK

Test no: 2

ID Arrival Burst Priority : Response Wait Turnaround

A 0 8 3 : 0 0 8

B 8 6 3 : 0 4 10

C 9 13 1 : 1 7 20

D 24 6 4 : 1 3 9

E 32 9 3 : 1 1 10

F 42 15 2 : 0 35 50

G 43 5 1 : 1 6 11

H 49 9 1 : 2 27 36

I 54 9 4 : 2 34 43

J 62 8 4 : 3 36 44

K 66 8 2 : 4 37 45

L 72 11 1 : 5 41 52

M 80 9 4 : 6 34 43

N 86 14 3 : 6 30 44

Average wait : 295/14 = 21.071

Average response : 32/14 = 2.286

Average turnaround : 425/14 = 30.357

Throughput: 14/130 = 0.107692 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAABBCBCBCBCBCCCCCCCDCDCDDDDEEEEEEEEEFFGFGFGFGHFGHFIHFIHFIHFJIHFJKIHFJKILHFJKILHFMJKILFNMJKILNMJKLNMJKLNMKLNMLNMLNMLNMLNNNNNN

Test no: 3

ID Arrival Burst Priority : Response Wait Turnaround

A 0 7 4 : 0 0 7

B 9 3 3 : 0 0 3

C 13 6 2 : 0 3 9

D 15 13 1 : 1 22 35

E 21 7 4 : 2 13 20

F 29 11 3 : 2 33 44

G 31 9 3 : 3 25 34

H 40 14 4 : 4 58 72

I 56 9 3 : 3 44 53

J 61 16 2 : 4 49 65

K 63 7 1 : 5 38 45

L 65 13 4 : 5 45 58

M 73 4 2 : 5 23 27

N 77 4 3 : 6 24 28

Average wait : 377/14 = 26.929

Average response : 40/14 = 2.857

Average turnaround : 500/14 = 35.714

Throughput: 14/126 = 0.111111 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAA..BBB.CCCDCDCDCDEDEDEDEDFEDGFEDGFEDGFHDGFHDGFHGFHGFHIGFHIGJFHKILJFHKILJMHKILNJMHKILNJMHKILNJMHKILNJHKILJHLJLJLJLJLJLJJJ

Test no: 4

ID Arrival Burst Priority : Response Wait Turnaround

A 0 9 3 : 0 4 13

B 4 16 1 : 1 25 41

C 15 4 2 : 1 4 8

D 21 7 3 : 2 20 27

E 25 8 4 : 2 35 43

F 29 6 3 : 3 31 37

G 32 13 4 : 4 74 87

H 35 13 1 : 5 76 89

I 43 6 2 : 6 39 45

J 45 7 3 : 6 46 53

K 49 10 2 : 6 61 71

L 57 11 2 : 7 61 72

M 60 15 4 : 8 62 77

N 73 12 2 : 7 50 62

Average wait : 588/14 = 42.000

Average response : 58/14 = 4.143

Average turnaround : 725/14 = 51.786

Throughput: 14/137 = 0.102190 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAABABABABABBBCBCBCBCDBDBEDBEDFBEDGFBEHDGFBEHDGIFJEHGKIFJEHGKILFJEMHGKILJMHGKINLJMHGKINLJMHGKNLJMHGKNLMHGKNLMHGKNLMHGKNLMHNLMNLMNMNMNMM

All 5 tests for [Round Robin] done, averages:

Wait : 24.271

Response : 2.614

Turnaround: 33.743

Throughput: 10.479 per 100 quanta

\*\*\* Testing algorithm: Highest Priority (non-preemptive) \*\*\*

Test no: 0

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 2 : 0 0 16

B 13 5 4 : 3 3 8

C 17 13 4 : 4 4 17

D 31 9 3 : 3 3 12

E 38 4 4 : 39 39 43

F 39 12 1 : 4 4 16

G 53 14 1 : 2 2 16

H 68 8 1 : 1 1 9

I 75 13 4 : 11 11 24

J 81 5 2 : 0 0 5

K 86 5 4 : ~ ~ ~

L 93 14 2 : 6 6 20

M 106 3 2 : ~ ~ ~

N 107 15 4 : ~ ~ ~

Average wait : 73/11 = 6.636

Average response : 73/11 = 6.636

Average turnaround : 186/11 = 16.909

Throughput: 11/113 = 0.097345 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAABBBBBCCCCCCCCCCCCCDDDDDDDDDFFFFFFFFFFFFGGGGGGGGGGGGGGHHHHHHHHEEEEJJJJJIIIIIIIIIIIIILLLLLLLLLLLLLL

Test no: 1

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 3 : 0 0 16

B 17 3 4 : 0 0 3

C 22 8 2 : 0 0 8

D 28 11 4 : 2 2 13

E 36 9 3 : 5 5 14

F 39 16 4 : 11 11 27

G 55 5 2 : 11 11 16

H 62 12 2 : 9 9 21

I 68 13 3 : ~ ~ ~

J 82 9 2 : 16 16 25

K 83 15 1 : 0 0 15

L 90 10 4 : ~ ~ ~

M 98 5 4 : ~ ~ ~

N 100 5 2 : ~ ~ ~

Average wait : 54/10 = 5.400

Average response : 54/10 = 5.400

Average turnaround : 158/10 = 15.800

Throughput: 10/107 = 0.093458 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAA.BBB..CCCCCCCCDDDDDDDDDDDEEEEEEEEEFFFFFFFFFFFFFFFFGGGGGHHHHHHHHHHHHKKKKKKKKKKKKKKKJJJJJJJJJ

Test no: 2

ID Arrival Burst Priority : Response Wait Turnaround

A 0 8 3 : 0 0 8

B 8 6 3 : 0 0 6

C 9 13 1 : 5 5 18

D 24 6 4 : 3 3 9

E 32 9 3 : 1 1 10

F 42 15 2 : 0 0 15

G 43 5 1 : 14 14 19

H 49 9 1 : 13 13 22

I 54 9 4 : ~ ~ ~

J 62 8 4 : ~ ~ ~

K 66 8 2 : 5 5 13

L 72 11 1 : 7 7 18

M 80 9 4 : ~ ~ ~

N 86 14 3 : 4 4 18

Average wait : 52/11 = 4.727

Average response : 52/11 = 4.727

Average turnaround : 156/11 = 14.182

Throughput: 11/104 = 0.105769 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAABBBBBBCCCCCCCCCCCCCDDDDDDEEEEEEEEEFFFFFFFFFFFFFFFGGGGGHHHHHHHHHKKKKKKKKLLLLLLLLLLLNNNNNNNNNNNNNN

Test no: 3

ID Arrival Burst Priority : Response Wait Turnaround

A 0 7 4 : 0 0 7

B 9 3 3 : 0 0 3

C 13 6 2 : 0 0 6

D 15 13 1 : 4 4 17

E 21 7 4 : 31 31 38

F 29 11 3 : 3 3 14

G 31 9 3 : 12 12 21

H 40 14 4 : 59 59 73

I 56 9 3 : 3 3 12

J 61 16 2 : 14 14 30

K 63 7 1 : 5 5 12

L 65 13 4 : ~ ~ ~

M 73 4 2 : 18 18 22

N 77 4 3 : 18 18 22

Average wait : 167/13 = 12.846

Average response : 167/13 = 12.846

Average turnaround : 277/13 = 21.308

Throughput: 13/113 = 0.115044 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAA..BBB.CCCCCCDDDDDDDDDDDDDFFFFFFFFFFFGGGGGGGGGEEEEEEEIIIIIIIIIKKKKKKKJJJJJJJJJJJJJJJJMMMMNNNNHHHHHHHHHHHHHH

Test no: 4

ID Arrival Burst Priority : Response Wait Turnaround

A 0 9 3 : 0 0 9

B 4 16 1 : 5 5 21

C 15 4 2 : 10 10 14

D 21 7 3 : 8 8 15

E 25 8 4 : ~ ~ ~

F 29 6 3 : 59 59 65

G 32 13 4 : ~ ~ ~

H 35 13 1 : 1 1 14

I 43 6 2 : 6 6 12

J 45 7 3 : 49 49 56

K 49 10 2 : 6 6 16

L 57 11 2 : 8 8 19

M 60 15 4 : ~ ~ ~

N 73 12 2 : 3 3 15

Average wait : 155/11 = 14.091

Average response : 155/11 = 14.091

Average turnaround : 256/11 = 23.273

Throughput: 11/101 = 0.108911 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAABBBBBBBBBBBBBBBBCCCCDDDDDDDHHHHHHHHHHHHHIIIIIIKKKKKKKKKKLLLLLLLLLLLNNNNNNNNNNNNFFFFFFJJJJJJJ

All 5 tests for [Highest Priority (non-preemptive)] done, averages:

Wait : 8.740

Response : 8.740

Turnaround: 18.294

Throughput: 10.411 per 100 quanta

\*\*\* Testing algorithm: Highest Priority (preemptive) \*\*\*

Test no: 0

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 2 : 0 0 16

B 13 5 4 : 3 3 8

C 17 13 4 : 4 51 64

D 31 9 3 : 0 12 21

E 38 4 4 : 29 37 41

F 39 12 1 : 0 0 12

G 53 14 1 : 0 0 14

H 68 8 1 : 0 0 8

I 75 13 4 : 11 28 41

J 81 5 2 : 0 0 5

K 86 5 4 : ~ ~ ~

L 93 14 2 : 0 0 14

M 106 3 2 : 1 1 4

N 107 15 4 : ~ ~ ~

Average wait : 132/12 = 11.000

Average response : 48/12 = 4.000

Average turnaround : 248/12 = 20.667

Throughput: 12/116 = 0.103448 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAABBBBBCCCCCCCCCCDDDDDDDDFFFFFFFFFFFFDCGGGGGGGGGGGGGGEHHHHHHHHEEECCJJJJJIIIIIIILLLLLLLLLLLLLLMMMIIIIII

Test no: 1

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 3 : 0 0 16

B 17 3 4 : 0 0 3

C 22 8 2 : 0 0 8

D 28 11 4 : 2 11 22

E 36 9 3 : 0 0 9

F 39 16 4 : 11 65 81

G 55 5 2 : 0 0 5

H 62 12 2 : 0 0 12

I 68 13 3 : 6 30 43

J 82 9 2 : 0 15 24

K 83 15 1 : 0 0 15

L 90 10 4 : ~ ~ ~

M 98 5 4 : ~ ~ ~

N 100 5 2 : ~ ~ ~

Average wait : 121/11 = 11.000

Average response : 19/11 = 1.727

Average turnaround : 238/11 = 21.636

Throughput: 11/120 = 0.091667 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAA.BBB..CCCCCCCCDDDDDDEEEEEEEEEDDDDDFFFFFGGGGGFFHHHHHHHHHHHHIIIIIIIIJKKKKKKKKKKKKKKKJJJJJJJJIIIIIFFFFFFFFF

Test no: 2

ID Arrival Burst Priority : Response Wait Turnaround

A 0 8 3 : 0 0 8

B 8 6 3 : 0 13 19

C 9 13 1 : 0 0 13

D 24 6 4 : 3 12 18

E 32 9 3 : 0 0 9

F 42 15 2 : 0 14 29

G 43 5 1 : 0 0 5

H 49 9 1 : 0 0 9

I 54 9 4 : ~ ~ ~

J 62 8 4 : ~ ~ ~

K 66 8 2 : 5 16 24

L 72 11 1 : 0 0 11

M 80 9 4 : ~ ~ ~

N 86 14 3 : 4 4 18

Average wait : 59/11 = 5.364

Average response : 12/11 = 1.091

Average turnaround : 163/11 = 14.818

Throughput: 11/104 = 0.105769 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAABCCCCCCCCCCCCCBBBBBDDDDDEEEEEEEEEDFGGGGGFHHHHHHHHHFFFFFFFFFFFFFKLLLLLLLLLLLKKKKKKKNNNNNNNNNNNNNN

Test no: 3

ID Arrival Burst Priority : Response Wait Turnaround

A 0 7 4 : 0 0 7

B 9 3 3 : 0 0 3

C 13 6 2 : 0 13 19

D 15 13 1 : 0 0 13

E 21 7 4 : ~ ~ ~

F 29 11 3 : 3 3 14

G 31 9 3 : 12 12 21

H 40 14 4 : 12 52 66

I 56 9 3 : 0 31 40

J 61 16 2 : 0 7 23

K 63 7 1 : 0 0 7

L 65 13 4 : ~ ~ ~

M 73 4 2 : 11 11 15

N 77 4 3 : 11 11 15

Average wait : 140/12 = 11.667

Average response : 49/12 = 4.083

Average turnaround : 243/12 = 20.250

Throughput: 12/106 = 0.113208 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAA..BBB.CCDDDDDDDDDDDDDCCCCFFFFFFFFFFFGGGGGGGGGHHHHIIIIIJJKKKKKKKJJJJJJJJJJJJJJMMMMNNNNIIIIHHHHHHHHHH

Test no: 4

ID Arrival Burst Priority : Response Wait Turnaround

A 0 9 3 : 0 20 29

B 4 16 1 : 0 0 16

C 15 4 2 : 5 5 9

D 21 7 3 : 8 73 80

E 25 8 4 : ~ ~ ~

F 29 6 3 : 65 65 71

G 32 13 4 : ~ ~ ~

H 35 13 1 : 0 0 13

I 43 6 2 : 5 5 11

J 45 7 3 : 42 42 49

K 49 10 2 : 5 5 15

L 57 11 2 : 7 7 18

M 60 15 4 : ~ ~ ~

N 73 12 2 : 2 2 14

Average wait : 224/11 = 20.364

Average response : 139/11 = 12.636

Average turnaround : 325/11 = 29.545

Throughput: 11/101 = 0.108911 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAABBBBBBBBBBBBBBBBCCCCAAAAADDDDDDHHHHHHHHHHHHHIIIIIIKKKKKKKKKKLLLLLLLLLLLNNNNNNNNNNNNJJJJJJJFFFFFFD

All 5 tests for [Highest Priority (preemptive)] done, averages:

Wait : 11.879

Response : 4.708

Turnaround: 21.383

Throughput: 10.460 per 100 quanta

\*\*\* Testing algorithm: HPF-Aging (non-preemptive) \*\*\*

Test no: 0

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 2 : 0 0 16

B 13 5 4 : 3 3 8

C 17 13 4 : 4 4 17

D 31 9 3 : 3 3 12

E 38 4 4 : 17 17 21

F 39 12 1 : 4 4 16

G 53 14 1 : 6 6 20

H 68 8 1 : 5 5 13

I 75 13 4 : 11 11 24

J 81 5 2 : 0 0 5

K 86 5 4 : ~ ~ ~

L 93 14 2 : 6 6 20

M 106 3 2 : ~ ~ ~

N 107 15 4 : ~ ~ ~

Average wait : 59/11 = 5.364

Average response : 59/11 = 5.364

Average turnaround : 172/11 = 15.636

Throughput: 11/113 = 0.097345 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAABBBBBCCCCCCCCCCCCCDDDDDDDDDFFFFFFFFFFFFEEEEGGGGGGGGGGGGGGHHHHHHHHJJJJJIIIIIIIIIIIIILLLLLLLLLLLLLL

Test no: 1

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 3 : 0 0 16

B 17 3 4 : 0 0 3

C 22 8 2 : 0 0 8

D 28 11 4 : 2 2 13

E 36 9 3 : 5 5 14

F 39 16 4 : 11 11 27

G 55 5 2 : 11 11 16

H 62 12 2 : 9 9 21

I 68 13 3 : 15 15 28

J 82 9 2 : ~ ~ ~

K 83 15 1 : 13 13 28

L 90 10 4 : ~ ~ ~

M 98 5 4 : ~ ~ ~

N 100 5 2 : ~ ~ ~

Average wait : 66/10 = 6.600

Average response : 66/10 = 6.600

Average turnaround : 174/10 = 17.400

Throughput: 10/111 = 0.090090 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAA.BBB..CCCCCCCCDDDDDDDDDDDEEEEEEEEEFFFFFFFFFFFFFFFFGGGGGHHHHHHHHHHHHIIIIIIIIIIIIIKKKKKKKKKKKKKKK

Test no: 2

ID Arrival Burst Priority : Response Wait Turnaround

A 0 8 3 : 0 0 8

B 8 6 3 : 0 0 6

C 9 13 1 : 5 5 18

D 24 6 4 : 3 3 9

E 32 9 3 : 1 1 10

F 42 15 2 : 0 0 15

G 43 5 1 : 14 14 19

H 49 9 1 : 13 13 22

I 54 9 4 : 17 17 26

J 62 8 4 : 37 37 45

K 66 8 2 : 14 14 22

L 72 11 1 : 16 16 27

M 80 9 4 : ~ ~ ~

N 86 14 3 : ~ ~ ~

Average wait : 120/12 = 10.000

Average response : 120/12 = 10.000

Average turnaround : 227/12 = 18.917

Throughput: 12/107 = 0.112150 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAABBBBBBCCCCCCCCCCCCCDDDDDDEEEEEEEEEFFFFFFFFFFFFFFFGGGGGHHHHHHHHHIIIIIIIIIKKKKKKKKLLLLLLLLLLLJJJJJJJJ

Test no: 3

ID Arrival Burst Priority : Response Wait Turnaround

A 0 7 4 : 0 0 7

B 9 3 3 : 0 0 3

C 13 6 2 : 0 0 6

D 15 13 1 : 4 4 17

E 21 7 4 : 11 11 18

F 29 11 3 : 10 10 21

G 31 9 3 : 19 19 28

H 40 14 4 : 19 19 33

I 56 9 3 : 24 24 33

J 61 16 2 : 28 28 44

K 63 7 1 : 10 10 17

L 65 13 4 : ~ ~ ~

M 73 4 2 : ~ ~ ~

N 77 4 3 : ~ ~ ~

Average wait : 125/11 = 11.364

Average response : 125/11 = 11.364

Average turnaround : 227/11 = 20.636

Throughput: 11/105 = 0.104762 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAA..BBB.CCCCCCDDDDDDDDDDDDDEEEEEEEFFFFFFFFFFFGGGGGGGGGHHHHHHHHHHHHHHKKKKKKKIIIIIIIIIJJJJJJJJJJJJJJJJ

Test no: 4

ID Arrival Burst Priority : Response Wait Turnaround

A 0 9 3 : 0 0 9

B 4 16 1 : 5 5 21

C 15 4 2 : 10 10 14

D 21 7 3 : 8 8 15

E 25 8 4 : 30 30 38

F 29 6 3 : 20 20 26

G 32 13 4 : 31 31 44

H 35 13 1 : 1 1 14

I 43 6 2 : 33 33 39

J 45 7 3 : 47 47 54

K 49 10 2 : 33 33 43

L 57 11 2 : 42 42 53

M 60 15 4 : ~ ~ ~

N 73 12 2 : ~ ~ ~

Average wait : 260/12 = 21.667

Average response : 260/12 = 21.667

Average turnaround : 370/12 = 30.833

Throughput: 12/110 = 0.109091 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAABBBBBBBBBBBBBBBBCCCCDDDDDDDHHHHHHHHHHHHHFFFFFFEEEEEEEEGGGGGGGGGGGGGIIIIIIKKKKKKKKKKJJJJJJJLLLLLLLLLLL

All 5 tests for [HPF-Aging (non-preemptive)] done, averages:

Wait : 10.999

Response : 10.999

Turnaround: 20.685

Throughput: 10.269 per 100 quanta

\*\*\* Testing algorithm: HPF-Aging (preemptive) \*\*\*

Test no: 0

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 2 : 0 0 16

B 13 5 4 : 3 3 8

C 17 13 4 : 4 4 17

D 31 9 3 : 3 15 24

E 38 4 4 : 17 17 21

F 39 12 1 : 0 0 12

G 53 14 1 : 6 6 20

H 68 8 1 : 5 5 13

I 75 13 4 : 11 11 24

J 81 5 2 : 0 0 5

K 86 5 4 : ~ ~ ~

L 93 14 2 : 6 6 20

M 106 3 2 : ~ ~ ~

N 107 15 4 : ~ ~ ~

Average wait : 67/11 = 6.091

Average response : 55/11 = 5.000

Average turnaround : 180/11 = 16.364

Throughput: 11/113 = 0.097345 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAABBBBBCCCCCCCCCCCCCDDDDDFFFFFFFFFFFFDDDDEEEEGGGGGGGGGGGGGGHHHHHHHHJJJJJIIIIIIIIIIIIILLLLLLLLLLLLLL

Test no: 1

ID Arrival Burst Priority : Response Wait Turnaround

A 0 16 3 : 0 0 16

B 17 3 4 : 0 0 3

C 22 8 2 : 0 0 8

D 28 11 4 : 2 2 13

E 36 9 3 : 5 5 14

F 39 16 4 : 11 11 27

G 55 5 2 : 11 11 16

H 62 12 2 : 9 9 21

I 68 13 3 : 15 15 28

J 82 9 2 : ~ ~ ~

K 83 15 1 : 13 13 28

L 90 10 4 : ~ ~ ~

M 98 5 4 : ~ ~ ~

N 100 5 2 : ~ ~ ~

Average wait : 66/10 = 6.600

Average response : 66/10 = 6.600

Average turnaround : 174/10 = 17.400

Throughput: 10/111 = 0.090090 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAAAAAAAAAA.BBB..CCCCCCCCDDDDDDDDDDDEEEEEEEEEFFFFFFFFFFFFFFFFGGGGGHHHHHHHHHHHHIIIIIIIIIIIIIKKKKKKKKKKKKKKK

Test no: 2

ID Arrival Burst Priority : Response Wait Turnaround

A 0 8 3 : 0 0 8

B 8 6 3 : 0 13 19

C 9 13 1 : 0 0 13

D 24 6 4 : 3 3 9

E 32 9 3 : 1 1 10

F 42 15 2 : 0 5 20

G 43 5 1 : 0 0 5

H 49 9 1 : 13 13 22

I 54 9 4 : 17 17 26

J 62 8 4 : 37 37 45

K 66 8 2 : 14 14 22

L 72 11 1 : 16 16 27

M 80 9 4 : ~ ~ ~

N 86 14 3 : ~ ~ ~

Average wait : 119/12 = 9.917

Average response : 101/12 = 8.417

Average turnaround : 226/12 = 18.833

Throughput: 12/107 = 0.112150 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAAABCCCCCCCCCCCCCBBBBBDDDDDDEEEEEEEEEFGGGGGFFFFFFFFFFFFFFHHHHHHHHHIIIIIIIIIKKKKKKKKLLLLLLLLLLLJJJJJJJJ

Test no: 3

ID Arrival Burst Priority : Response Wait Turnaround

A 0 7 4 : 0 0 7

B 9 3 3 : 0 0 3

C 13 6 2 : 0 13 19

D 15 13 1 : 0 0 13

E 21 7 4 : 11 11 18

F 29 11 3 : 10 10 21

G 31 9 3 : 19 19 28

H 40 14 4 : 19 19 33

I 56 9 3 : 40 40 49

J 61 16 2 : 19 19 35

K 63 7 1 : 10 10 17

L 65 13 4 : ~ ~ ~

M 73 4 2 : ~ ~ ~

N 77 4 3 : ~ ~ ~

Average wait : 141/11 = 12.818

Average response : 128/11 = 11.636

Average turnaround : 243/11 = 22.091

Throughput: 11/105 = 0.104762 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAAAAA..BBB.CCDDDDDDDDDDDDDCCCCEEEEEEEFFFFFFFFFFFGGGGGGGGGHHHHHHHHHHHHHHKKKKKKKJJJJJJJJJJJJJJJJIIIIIIIII

Test no: 4

ID Arrival Burst Priority : Response Wait Turnaround

A 0 9 3 : 0 16 25

B 4 16 1 : 0 0 16

C 15 4 2 : 10 10 14

D 21 7 3 : 8 8 15

E 25 8 4 : 30 30 38

F 29 6 3 : 20 20 26

G 32 13 4 : 31 31 44

H 35 13 1 : 1 1 14

I 43 6 2 : 33 33 39

J 45 7 3 : 47 47 54

K 49 10 2 : 33 33 43

L 57 11 2 : 42 42 53

M 60 15 4 : ~ ~ ~

N 73 12 2 : ~ ~ ~

Average wait : 271/12 = 22.583

Average response : 255/12 = 21.250

Average turnaround : 381/12 = 31.750

Throughput: 12/110 = 0.109091 per single quantum

Execution chart:

0 1 2 3 4 5 6 7 8 9 10 11 12

0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8 0 2 4 6 8

AAAABBBBBBBBBBBBBBBBAAAAACCCCDDDDDDDHHHHHHHHHHHHHFFFFFFEEEEEEEEGGGGGGGGGGGGGIIIIIIKKKKKKKKKKJJJJJJJLLLLLLLLLLL

All 5 tests for [HPF-Aging (preemptive)] done, averages:

Wait : 11.602

Response : 10.581

Turnaround: 21.288

Throughput: 10.269 per 100 quanta

Process returned 0 (0x0) execution time : 6.357 s

Press any key to continue.