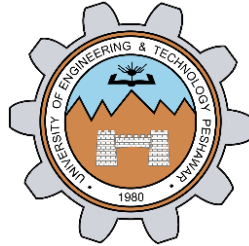


Simulation of Non-preemptive Process Scheduling Algorithms

LAB # 10



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CSE-204L Operating Systems Lab

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Class Section: **C**

“On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work.”

Submitted to:

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Date:

26th June 2023

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WRITE A C PROGRAM FOR CPU SCHEDULING ALGORITHM FOR FCFS

DESCRIPTION:

The implementation of the FCFS policy is easily managed with a FIFO queue. When a process enters the ready queue, its PCB is linked to the tail of the queue. When the CPU is free it is allocated to the process at that end of the queue. The running process is then removed from the queue.

Data Structures Required:

For all CPU scheduling algorithm implementations, we need to have the following arrays.

A two-dimensional array "process [NUM_PROCESSES][INFO]" of data type float.

This array stores the job numbers, their arrival times, and their burst times, which are read from the user.

And this array also stores the additional data after some calculations. They are...

1. start time of the job,
2. finish time of the job,
3. waiting time of the job,
4. Turn around time of job.s

A row of the process array contains the following:

Process[1,0] = job number,

Process[1,1] = arrival time,

Process[1,2] = burst time,

And after calculations...

Process[1,3] = start time,

Process[1,4] = finish time,
Process[1,5] = waiting time,
Process[1,6] = turn around time,

The remaining columns may be used while implementing the other algorithms.

Variables **avgwt** and **avgtat** of type float indicate average waiting time and average turnaround time respectively, and variable TOT_JOBS for keeping track of the number of jobs.

Functions Needed:

While implementing algorithms one can implement his/her own logic and can write own functions, which is up to the programmers. As far as possible, avoid using global variables.

Though it is so, the suggested functions for implementing these algorithms are

1. for reading the job entries (read_job_entry())
2. FCFS() for fcfs algorithm
3. SJF_non_preempt()for SJF algorithm,
4. Calculate() for doing various calculations like start times, finish times, waiting times, turn around times of jobs.
5. Sorting() for sorting the job entries by their arrival time (for FCFS), or by their burst time (for SJF), or by their priority (for Priority algo).
6. Print_sorted() for printing inputted data after sorting.
7. Printing(): Print the outputs after all the calculations are over.

PROCEDURE FOR FCFS

Read the number of jobs into variable tot_obs.

Then read the data for jobs as:

Job number, into the process [1, 0],

Job arrival time into the process [1, 1],

Job burst into process [1, 2], through read_job_entry().

Then sort the job entries by their arrival times because the FCFS algorithm works by arrival times.

Print the sorted jobs on the output.

Then go for calculations.

Then Print the results on the output.

The read function can be called from the main function. Then FCFS function can be as

```
FCFS() {  
    sort(...):  
    printf("The Scheduling  
    according to FCFS:");  
    print_sorted ( . . .);  
    calculated(... );  
    getch( );  
    printing( );  
    getch( );  
}
```

Code:

```
t1.c
~/Desktop/OS Lab/Lab10
Save

28     lf-----\n", p[i][0], p[i][AT], p[i][BT], p[i][ET], p[i][WT], p[i][TAT]);
29 }
30
31 void sort_array(int n, float p[][10]){
32
33     for(int i =0; i<n; i++){
34         for(int j=i+1; j<n; j++){
35             if(p[i][AT] > p[j][AT]){
36                 float temp;
37                 for(int k =0; k<10; k++){
38                     temp = p[i][k];
39                     p[i][k] = p[j][k];
40                     p[j][k] = temp;
41                 }
42             }
43         }
44     }
45 }
46
47 void calculate(int n, float p[][10]){
48
49     int prev_bt = p[0][BT] + p[0][AT] ;
50     p[0][ET] = prev_bt;
51
52     //End Time Calculation
53 }
```

C Tab Width: 4 Ln 15, Col 32 INS

```
t1.c
~/Desktop/OS Lab/Lab10
Save

1 #include<stdio.h>
2
3 #define AT 1
4 #define BT 2
5 #define ET 3
6 #define WT 4
7 #define TAT 5
8
9 void get_input(int n, float p[][10]){
10
11     for(int i =0; i<n; i++){
12         p[i][0] = i+1;
13
14         printf("Enter process %d arrival time\n", i+1);
15         scanf("%f", &p[i][AT]);
16
17         printf("Enter process %d burst time\n", i+1);
18         scanf("%f", &p[i][BT]);
19     }
20 }
21
22 void print_array(int n, float p[][10]){
23     printf("Process Job Number:\tArrival time\tburst time\tEnd time\tWait time\tTurnAround time\n");
24
25     for(int i =0; i<n; i++){
26         printf("-----%.1f-----\t-----%.1f-----\t-----%.1f-----\t-----%.1f-----\t-----%.1f-----\t-----%.1f-----\n",
27             p[i][0], p[i][AT], p[i][BT], p[i][ET], p[i][WT], p[i][TAT]);
28     }
```

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```
Open t1.c t1.c t1.c
56 for(int i=1; i<n; i++){
57     prev_bt += p[i][BT];
58     p[i][ET] = prev_bt;
59 }
60
61 //Wait Time Calculation
62 for(int i=0; i<n; i++){
63     p[i][WT] = p[i][ET] - p[i][BT] - p[i][AT] ;
64 }
65
66 //TurnAround Time Calculation
67 for(int i=0; i<n; i++){
68     p[i][TAT] = p[i][WT] + p[i][BT];
69 }
70 }
71 int main(){
72
73     int n;
74     printf("Enter the total number of jobs\n");
75     scanf("%d", &n);
76     float processes[n][10];
77
78     get_input(n, processes);
79     print_array(n, processes);
80     sort_array(n, processes);
81     calculate(n, processes);
82     print_array(n, processes);
83     return 0;
84 }
```

Output:

```
ali@Ubuntu22: ~/Desktop/OS Lab/Lab10
ali@Ubuntu22:~/Desktop/OS Lab/Lab10$ gcc t1.c -o t1.o
ali@Ubuntu22:~/Desktop/OS Lab/Lab10$ ./t1.o
Enter the total number of jobs
4
Enter process 1 arrival time
2
Enter process 1 burst time
3
Enter process 2 arrival time
4
Enter process 2 burst time
5
Enter process 3 arrival time
7
Enter process 3 burst time
8
Enter process 4 arrival time
5
Enter process 4 burst time
9
Process Job Number:   Arrival time   burst time:   End time:     Wait time:    TurnAround time
-----1.0-----   -----2.0-----   -----3.0-----   -----0.0-----   -----0.0-----   -----0.0-----
-----2.0-----   -----4.0-----   -----5.0-----   -----0.0-----   -----0.0-----   -----0.0-----
-----3.0-----   -----7.0-----   -----8.0-----   -----0.0-----   -----0.0-----   -----0.0-----
-----4.0-----   -----5.0-----   -----9.0-----   -----0.0-----   -----0.0-----   -----0.0-----
Process Job Number:   Arrival time   burst time:   End time:     Wait time:    TurnAround time
-----1.0-----   -----2.0-----   -----3.0-----   -----5.0-----   -----0.0-----   -----3.0-----
-----2.0-----   -----4.0-----   -----5.0-----   -----10.0-----   -----1.0-----   -----6.0-----
-----4.0-----   -----5.0-----   -----9.0-----   -----19.0-----   -----5.0-----   -----14.0-----
-----3.0-----   -----7.0-----   -----8.0-----   -----27.0-----   -----12.0-----   -----20.0-----
ali@Ubuntu22:~/Desktop/OS Lab/Lab10$
```

Code:

```

22
23 void print_array(int n, float p[][10]){
24     printf("Process Job Number:\tArrival time\tburst time:\tEnd time:\tWait
25
26     for(int i =0; i<n; i++){
27         printf("-----%.1f-----\t-----%.1f-----\t-----%.1f-----\t-----%.1f-
28         1f-----\n", p[i][0], p[i][AT], p[i][BT], p[i][ET], p[i][WT], p[i][TAT]);
29     }
30
31 void sort_array(int n, float p[][10]){
32
33     for(int i =0; i<n; i++){
34
35         for(int j=i+1; j<n; j++){
36
37             if(p[i][BT] > p[j][BT]){
38                 float temp;
39
40                 for(int k =0; k<10; k++){
41                     temp = p[i][k];
42                     p[i][k] = p[j][k];
43                     p[j][k] = temp;
44

```

```

45     }
46 }
47 }
48 }
49
50
51 void init_entries(int n, float p[][10]){
52
53     for(int i =0; i<n; i++){
54         p[i][ET] = 0;
55         p[i][WT] = 0;
56         p[i][TAT] = 0;
57     }
58 }
59 void sort_arrayAT(int n, float p[][10]){
60
61     for(int i =0; i<n; i++){
62
63         for(int j=i+1; j<n; j++){
64
65             if(p[i][AT] > p[j][AT]){
66                 float temp;
67
68                 temp = p[i][AT];
69                 p[i][AT] = p[j][AT];
70                 p[j][AT] = temp;
71
72                 temp = p[i][BT];
73                 p[i][BT] = p[j][BT];
74                 p[j][BT] = temp;
75
76                 temp = p[i][ET];
77                 p[i][ET] = p[j][ET];
78                 p[j][ET] = temp;
79
80                 temp = p[i][WT];
81                 p[i][WT] = p[j][WT];
82                 p[j][WT] = temp;
83
84                 temp = p[i][TAT];
85                 p[i][TAT] = p[j][TAT];
86                 p[j][TAT] = temp;
87
88                 temp = p[i][CT];
89                 p[i][CT] = p[j][CT];
90                 p[j][CT] = temp;
91
92                 temp = p[i][ST];
93                 p[i][ST] = p[j][ST];
94                 p[j][ST] = temp;
95
96                 temp = p[i][PT];
97                 p[i][PT] = p[j][PT];
98                 p[j][PT] = temp;
99
100                temp = p[i][AT];
101                p[i][AT] = p[j][AT];
102                p[j][AT] = temp;
103
104                temp = p[i][BT];
105                p[i][BT] = p[j][BT];
106                p[j][BT] = temp;
107
108                temp = p[i][ET];
109                p[i][ET] = p[j][ET];
110                p[j][ET] = temp;
111
112                temp = p[i][WT];
113                p[i][WT] = p[j][WT];
114                p[j][WT] = temp;
115
116                temp = p[i][TAT];
117                p[i][TAT] = p[j][TAT];
118                p[j][TAT] = temp;
119
120                temp = p[i][CT];
121                p[i][CT] = p[j][CT];
122                p[j][CT] = temp;
123
124                temp = p[i][ST];
125                p[i][ST] = p[j][ST];
126                p[j][ST] = temp;
127
128                temp = p[i][PT];
129                p[i][PT] = p[j][PT];
130                p[j][PT] = temp;
131
132                temp = p[i][AT];
133                p[i][AT] = p[j][AT];
134                p[j][AT] = temp;
135
136                temp = p[i][BT];
137                p[i][BT] = p[j][BT];
138                p[j][BT] = temp;
139
140                temp = p[i][ET];
141                p[i][ET] = p[j][ET];
142                p[j][ET] = temp;
143
144                temp = p[i][WT];
145                p[i][WT] = p[j][WT];
146                p[j][WT] = temp;
147
148                temp = p[i][TAT];
149                p[i][TAT] = p[j][TAT];
150                p[j][TAT] = temp;
151
152                temp = p[i][CT];
153                p[i][CT] = p[j][CT];
154                p[j][CT] = temp;
155
156                temp = p[i][ST];
157                p[i][ST] = p[j][ST];
158                p[j][ST] = temp;
159
160                temp = p[i][PT];
161                p[i][PT] = p[j][PT];
162                p[j][PT] = temp;
163
164                temp = p[i][AT];
165                p[i][AT] = p[j][AT];
166                p[j][AT] = temp;
167
168                temp = p[i][BT];
169                p[i][BT] = p[j][BT];
170                p[j][BT] = temp;
171
172                temp = p[i][ET];
173                p[i][ET] = p[j][ET];
174                p[j][ET] = temp;
175
176                temp = p[i][WT];
177                p[i][WT] = p[j][WT];
178                p[j][WT] = temp;
179
180                temp = p[i][TAT];
181                p[i][TAT] = p[j][TAT];
182                p[j][TAT] = temp;
183
184                temp = p[i][CT];
185                p[i][CT] = p[j][CT];
186                p[j][CT] = temp;
187
188                temp = p[i][ST];
189                p[i][ST] = p[j][ST];
190                p[j][ST] = temp;
191
192                temp = p[i][PT];
193                p[i][PT] = p[j][PT];
194                p[j][PT] = temp;
195
196                temp = p[i][AT];
197                p[i][AT] = p[j][AT];
198                p[j][AT] = temp;
199
200                temp = p[i][BT];
201                p[i][BT] = p[j][BT];
202                p[j][BT] = temp;
203
204                temp = p[i][ET];
205                p[i][ET] = p[j][ET];
206                p[j][ET] = temp;
207
208                temp = p[i][WT];
209                p[i][WT] = p[j][WT];
210                p[j][WT] = temp;
211
212                temp = p[i][TAT];
213                p[i][TAT] = p[j][TAT];
214                p[j][TAT] = temp;
215
216                temp = p[i][CT];
217                p[i][CT] = p[j][CT];
218                p[j][CT] = temp;
219
220                temp = p[i][ST];
221                p[i][ST] = p[j][ST];
222                p[j][ST] = temp;
223
224                temp = p[i][PT];
225                p[i][PT] = p[j][PT];
226                p[j][PT] = temp;
227
228                temp = p[i][AT];
229                p[i][AT] = p[j][AT];
230                p[j][AT] = temp;
231
232                temp = p[i][BT];
233                p[i][BT] = p[j][BT];
234                p[j][BT] = temp;
235
236                temp = p[i][ET];
237                p[i][ET] = p[j][ET];
238                p[j][ET] = temp;
239
240                temp = p[i][WT];
241                p[i][WT] = p[j][WT];
242                p[j][WT] = temp;
243
244                temp = p[i][TAT];
245                p[i][TAT] = p[j][TAT];
246                p[j][TAT] = temp;
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248                temp = p[i][CT];
249                p[i][CT] = p[j][CT];
250                p[j][CT] = temp;
251
252                temp = p[i][ST];
253                p[i][ST] = p[j][ST];
254                p[j][ST] = temp;
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256                temp = p[i][PT];
257                p[i][PT] = p[j][PT];
258                p[j][PT] = temp;
259
260                temp = p[i][AT];
261                p[i][AT] = p[j][AT];
262                p[j][AT] = temp;
263
264                temp = p[i][BT];
265                p[i][BT] = p[j][BT];
266                p[j][BT] = temp;
267
268                temp = p[i][ET];
269                p[i][ET] = p[j][ET];
270                p[j][ET] = temp;
271
272                temp = p[i][WT];
273                p[i][WT] = p[j][WT];
274                p[j][WT] = temp;
275
276                temp = p[i][TAT];
277                p[i][TAT] = p[j][TAT];
278                p[j][TAT] = temp;
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280                temp = p[i][CT];
281                p[i][CT] = p[j][CT];
282                p[j][CT] = temp;
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284                temp = p[i][ST];
285                p[i][ST] = p[j][ST];
286                p[j][ST] = temp;
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288                temp = p[i][PT];
289                p[i][PT] = p[j][PT];
290                p[j][PT] = temp;
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292                temp = p[i][AT];
293                p[i][AT] = p[j][AT];
294                p[j][AT] = temp;
295
296                temp = p[i][BT];
297                p[i][BT] = p[j][BT];
298                p[j][BT] = temp;
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300                temp = p[i][ET];
301                p[i][ET] = p[j][ET];
302                p[j][ET] = temp;
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304                temp = p[i][WT];
305                p[i][WT] = p[j][WT];
306                p[j][WT] = temp;
307
308                temp = p[i][TAT];
309                p[i][TAT] = p[j][TAT];
310                p[j][TAT] = temp;
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312                temp = p[i][CT];
313                p[i][CT] = p[j][CT];
314                p[j][CT] = temp;
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316                temp = p[i][ST];
317                p[i][ST] = p[j][ST];
318                p[j][ST] = temp;
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320                temp = p[i][PT];
321                p[i][PT] = p[j][PT];
322                p[j][PT] = temp;
323
324                temp = p[i][AT];
325                p[i][AT] = p[j][AT];
326                p[j][AT] = temp;
327
328                temp = p[i][BT];
329                p[i][BT] = p[j][BT];
330                p[j][BT] = temp;
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332                temp = p[i][ET];
333                p[i][ET] = p[j][ET];
334                p[j][ET] = temp;
335
336                temp = p[i][WT];
337                p[i][WT] = p[j][WT];
338                p[j][WT] = temp;
339
340                temp = p[i][TAT];
341                p[i][TAT] = p[j][TAT];
342                p[j][TAT] = temp;
343
344                temp = p[i][CT];
345                p[i][CT] = p[j][CT];
346                p[j][CT] = temp;
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348                temp = p[i][ST];
349                p[i][ST] = p[j][ST];
350                p[j][ST] = temp;
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352                temp = p[i][PT];
353                p[i][PT] = p[j][PT];
354                p[j][PT] = temp;
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356                temp = p[i][AT];
357                p[i][AT] = p[j][AT];
358                p[j][AT] = temp;
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360                temp = p[i][BT];
361                p[i][BT] = p[j][BT];
362                p[j][BT] = temp;
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364                temp = p[i][ET];
365                p[i][ET] = p[j][ET];
366                p[j][ET] = temp;
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368                temp = p[i][WT];
369                p[i][WT] = p[j][WT];
370                p[j][WT] = temp;
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372                temp = p[i][TAT];
373                p[i][TAT] = p[j][TAT];
374                p[j][TAT] = temp;
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376                temp = p[i][CT];
377                p[i][CT] = p[j][CT];
378                p[j][CT] = temp;
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380                temp = p[i][ST];
381                p[i][ST] = p[j][ST];
382                p[j][ST] = temp;
383
384                temp = p[i][PT];
385                p[i][PT] = p[j][PT];
386                p[j][PT] = temp;
387
388                temp = p[i][AT];
389                p[i][AT] = p[j][AT];
390                p[j][AT] = temp;
391
392                temp = p[i][BT];
393                p[i][BT] = p[j][BT];
394                p[j][BT] = temp;
395
396                temp = p[i][ET];
397                p[i][ET] = p[j][ET];
398                p[j][ET] = temp;
399
400                temp = p[i][WT];
401                p[i][WT] = p[j][WT];
402                p[j][WT] = temp;
403
404                temp = p[i][TAT];
405                p[i][TAT] = p[j][TAT];
406                p[j][TAT] = temp;
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408                temp = p[i][CT];
409                p[i][CT] = p[j][CT];
410                p[j][CT] = temp;
411
412                temp = p[i][ST];
413                p[i][ST] = p[j][ST];
414                p[j][ST] = temp;
415
416                temp = p[i][PT];
417                p[i][PT] = p[j][PT];
418                p[j][PT] = temp;
419
420                temp = p[i][AT];
421                p[i][AT] = p[j][AT];
422                p[j][AT] = temp;
423
424                temp = p[i][BT];
425                p[i][BT] = p[j][BT];
426                p[j][BT] = temp;
427
428                temp = p[i][ET];
429                p[i][ET] = p[j][ET];
430                p[j][ET] = temp;
431
432                temp = p[i][WT];
433                p[i][WT] = p[j][WT];
434                p[j][WT] = temp;
435
436                temp = p[i][TAT];
437                p[i][TAT] = p[j][TAT];
438                p[j][TAT] = temp;
439
440                temp = p[i][CT];
441                p[i][CT] = p[j][CT];
442                p[j][CT] = temp;
443
444                temp = p[i][ST];
445                p[i][ST] = p[j][ST];
446                p[j][ST] = temp;
447
448                temp = p[i][PT];
449                p[i][PT] = p[j][PT];
450                p[j][PT] = temp;
451
452                temp = p[i][AT];
453                p[i][AT] = p[j][AT];
454                p[j][AT] = temp;
455
456                temp = p[i][BT];
457                p[i][BT] = p[j][BT];
458                p[j][BT] = temp;
459
460                temp = p[i][ET];
461                p[i][ET] = p[j][ET];
462                p[j][ET] = temp;
463
464                temp = p[i][WT];
465                p[i][WT] = p[j][WT];
466                p[j][WT] = temp;
467
468                temp = p[i][TAT];
469                p[i][TAT] = p[j][TAT];
470                p[j][TAT] = temp;
471
472                temp = p[i][CT];
473                p[i][CT] = p[j][CT];
474                p[j][CT] = temp;
475
476                temp = p[i][ST];
477                p[i][ST] = p[j][ST];
478                p[j][ST] = temp;
479
480                temp = p[i][PT];
481                p[i][PT] = p[j][PT];
482                p[j][PT] = temp;
483
484                temp = p[i][AT];
485                p[i][AT] = p[j][AT];
486                p[j][AT] = temp;
487
488                temp = p[i][BT];
489                p[i][BT] = p[j][BT];
490                p[j][BT] = temp;
491
492                temp = p[i][ET];
493                p[i][ET] = p[j][ET];
494                p[j][ET] = temp;
495
496                temp = p[i][WT];
497                p[i][WT] = p[j][WT];
498                p[j][WT] = temp;
499
500                temp = p[i][TAT];
501                p[i][TAT] = p[j][TAT];
502                p[j][TAT] = temp;
503
504                temp = p[i][CT];
505                p[i][CT] = p[j][CT];
506                p[j][CT] = temp;
507
508                temp = p[i][ST];
509                p[i][ST] = p[j][ST];
510                p[j][ST] = temp;
511
512                temp = p[i][PT];
513                p[i][PT] = p[j][PT];
514                p[j][PT] = temp;
515
516                temp = p[i][AT];
517                p[i][AT] = p[j][AT];
518                p[j][AT] = temp;
519
520                temp = p[i][BT];
521                p[i][BT] = p[j][BT];
522                p[j][BT] = temp;
523
524                temp = p[i][ET];
525                p[i][ET] = p[j][ET];
526                p[j][ET] = temp;
527
528                temp = p[i][WT];
529                p[i][WT] = p[j][WT];
530                p[j][WT] = temp;
531
532                temp = p[i][TAT];
533                p[i][TAT] = p[j][TAT];
534                p[j][TAT] = temp;
535
536                temp = p[i][CT];
537                p[i][CT] = p[j][CT];
538                p[j][CT] = temp;
539
540                temp = p[i][ST];
541                p[i][ST] = p[j][ST];
542                p[j][ST] = temp;
543
544                temp = p[i][PT];
545                p[i][PT] = p[j][PT];
546                p[j][PT] = temp;
547
548                temp = p[i][AT];
549                p[i][AT] = p[j][AT];
550                p[j][AT] = temp;
551
552                temp = p[i][BT];
553                p[i][BT] = p[j][BT];
554                p[j][BT] = temp;
555
556                temp = p[i][ET];
557                p[i][ET] = p[j][ET];
558                p[j][ET] = temp;
559
560                temp = p[i][WT];
561                p[i][WT] = p[j][WT];
562                p[j][WT] = temp;
563
564                temp = p[i][TAT];
565                p[i][TAT] = p[j][TAT];
566                p[j][TAT] = temp;
567
568                temp = p[i][CT];
569                p[i][CT] = p[j][CT];
570                p[j][CT] = temp;
571
572                temp = p[i][ST];
573                p[i][ST] = p[j][ST];
574                p[j][ST] = temp;
575
576                temp = p[i][PT];
577                p[i][PT] = p[j][PT];
578                p[j][PT] = temp;
579
580                temp = p[i][AT];
581                p[i][AT] = p[j][AT];
582                p[j][AT] = temp;
583
584                temp = p[i][BT];
585                p[i][BT] = p[j][BT];
586                p[j][BT] = temp;
587
588                temp = p[i][ET];
589                p[i][ET] = p[j][ET];
590                p[j][ET] = temp;
591
592                temp = p[i][WT];
593                p[i][WT] = p[j][WT];
594                p[j][WT] = temp;
595
596                temp = p[i][TAT];
597                p[i][TAT] = p[j][TAT];
598                p[j][TAT] = temp;
599
600                temp = p[i][CT];
601                p[i][CT] = p[j][CT];
602                p[j][CT] = temp;
603
604                temp = p[i][ST];
605                p[i][ST] = p[j][ST];
606                p[j][ST] = temp;
607
608                temp = p[i][PT];
609                p[i][PT] = p[j][PT];
610                p[j][PT] = temp;
611
612                temp = p[i][AT];
613                p[i][AT] = p[j][AT];
614                p[j][AT] = temp;
615
616                temp = p[i][BT];
617                p[i][BT] = p[j][BT];
618                p[j][BT] = temp;
619
620                temp = p[i][ET];
621                p[i][ET] = p[j][ET];
622                p[j][ET] = temp;
623
624                temp = p[i][WT];
625                p[i][WT] = p[j][WT];
626                p[j][WT] = temp;
627
628                temp = p[i][TAT];
629                p[i][TAT] = p[j][TAT];
630                p[j][TAT] = temp;
631
632                temp = p[i][CT];
633                p[i][CT] = p[j][CT];
634                p[j][CT] = temp;
635
636                temp = p[i][ST];
637                p[i][ST] = p[j][ST];
638                p[j][ST] = temp;
639
640                temp = p[i][PT];
641                p[i][PT] = p[j][PT];
642                p[j][PT] = temp;
643
644                temp = p[i][AT];
645                p[i][AT] = p[j][AT];
646                p[j][AT] = temp;
647
648                temp = p[i][BT];
649                p[i][BT] = p[j][BT];
650                p[j][BT] = temp;
651
652                temp = p[i][ET];
653                p[i][ET] = p[j][ET];
654                p[j][ET] = temp;
655
656                temp = p[i][WT];
657                p[i][WT] = p[j][WT];
658                p[j][WT] = temp;
659
660                temp = p[i][TAT];
661                p[i][TAT] = p[j][TAT];
662                p[j][TAT] = temp;
663
664                temp = p[i][CT];
665                p[i][CT] = p[j][CT];
666                p[j][CT] = temp;
667
668                temp = p[i][ST];
669                p[i][ST] = p[j][ST];
670                p[j][ST] = temp;
671
672                temp = p[i][PT];
673                p[i][PT] = p[j][PT];
674                p[j][PT] = temp;
675
676                temp = p[i][AT];
677                p[i][AT] = p[j][AT];
678                p[j][AT] = temp;
679
680                temp = p[i][BT];
681                p[i][BT] = p[j][BT];
682                p[j][BT] = temp;
683
684                temp = p[i][ET];
685                p[i][ET] = p[j][ET];
686                p[j][ET] = temp;
687
688                temp = p[i][WT];
689                p[i][WT] = p[j][WT];
690                p[j][WT] = temp;
691
692                temp = p[i][TAT];
693                p[i][TAT] = p[j][TAT];
694                p[j][TAT] = temp;
695
696                temp = p[i][CT];
697                p[i][CT] = p[j][CT];
698                p[j][CT] = temp;
699
700                temp = p[i][ST];
701                p[i][ST] = p[j][ST];
702                p[j][ST] = temp;
703
704                temp = p[i][PT];
705                p[i][PT] = p[j][PT];
706                p[j][PT] = temp;
707
708                temp = p[i][AT];
709                p[i][AT] = p[j][AT];
710                p[j][AT] = temp;
711
712                temp = p[i][BT];
713                p[i][BT] = p[j][BT];
714                p[j][BT] = temp;
715
716                temp = p[i][ET];
717                p[i][ET] = p[j][ET];
718                p[j][ET] = temp;
719
720                temp = p[i][WT];
721                p[i][WT] = p[j][WT];
722                p[j][WT] = temp;
723
724                temp = p[i][TAT];
725                p[i][TAT] = p[j][TAT];
726                p[j][TAT] = temp;
727
728                temp = p[i][CT];
729                p[i][CT] = p[j][CT];
730                p[j][CT] = temp;
731
732                temp = p[i][ST];
733                p[i][ST] = p[j][ST];
734                p[j][ST] = temp;
735
736                temp = p[i][PT];
737                p[i][PT] = p[j][PT];
738                p[j][PT] = temp;
739
740                temp = p[i][AT];
741                p[i][AT] = p[j][AT];
742                p[j][AT] = temp;
743
744                temp = p[i][BT];
745                p[i][BT] = p[j][BT];
746                p[j][BT] = temp;
747
748                temp = p[i][ET];
749                p[i][ET] = p[j][ET];
750                p[j][ET] = temp;
751
752                temp = p[i][WT];
753                p[i][WT] = p[j][WT];
754                p[j][WT] = temp;
755
756                temp = p[i][TAT];
757                p[i][TAT] = p[j][TAT];
758                p[j][TAT] = temp;
759
760                temp = p[i][CT];
761                p[i][CT] = p[j][CT];
762                p[j][CT] = temp;
763
764                temp = p[i][ST];
765                p[i][ST] = p[j][ST];
766                p[j][ST] = temp;
767
768                temp = p[i][PT];
769                p[i][PT] = p[j][PT];
770                p[j][PT] = temp;
771
772                temp = p[i][AT];
773                p[i][AT] = p[j][AT];
774                p[j][AT] = temp;
775
776                temp = p[i][BT];
777                p[i][BT] = p[j][BT];
778                p[j][BT] = temp;
779
780                temp = p[i][ET];
781                p[i][ET] = p[j][ET];
782                p[j][ET] = temp;
783
784                temp = p[i][WT];
785                p[i][WT] = p[j][WT];
786                p[j][WT] = temp;
787
788                temp = p[i][TAT];
789                p[i][TAT] = p[j][TAT];
790                p[j][TAT] = temp;
791
792                temp = p[i][CT];
793                p[i][CT] = p[j][CT];
794                p[j][CT] = temp;
795
796                temp = p[i][ST];
797                p[i][ST] = p[j][ST];
798                p[j][ST] = temp;
799
800                temp = p[i][PT];
801                p[i][PT] = p[j][PT];
802                p[j][PT] = temp;
803
804                temp = p[i][AT];
805                p[i][AT] = p[j][AT];
806                p[j][AT] = temp;
807
808                temp = p[i][BT];
809                p[i][BT] = p[j][BT];
810                p[j][BT] = temp;
811
812                temp = p[i][ET];
813                p[i][ET] = p[j][ET];
814                p[j][ET] = temp;
815
816                temp = p[i][WT];
817                p[i][WT] = p[j][WT];
818                p[j][WT] = temp;
819
820                temp = p[i][TAT];
821                p[i][TAT] = p[j][TAT];
822                p[j][TAT] = temp;
823
824                temp = p[i][CT];
825                p[i][CT] = p[j][CT];
826                p[j][CT] = temp;
827
828                temp = p[i][ST];
829                p[i][ST] = p[j][ST];
830                p[j][ST] = temp;
831
832                temp = p[i][PT];
833                p[i][PT] = p[j][PT];
834                p[j][PT] = temp;
835
836                temp = p[i][AT];
837                p[i][AT] = p[j][AT];
838                p[j][AT] = temp;
839
840                temp = p[i][BT];
841                p[i][BT] = p[j][BT];
842                p[j][BT] = temp;
843
844                temp = p[i][ET];
845                p[i][ET] = p[j][ET];
846                p[j][ET] = temp;
847
848                temp = p[i][WT];
849                p[i][WT] = p[j][WT];
850                p[j][WT] = temp;
851
852                temp = p[i][TAT];
853                p[i][TAT] = p[j][TAT];
854                p[j][TAT] = temp;
855
856                temp = p[i][CT];
857                p[i][CT] = p[j][CT];
858                p[j][CT] = temp;
859
860                temp = p[i][ST];
861                p[i][ST] = p[j][ST];
862                p[j][ST] = temp;
863
864                temp = p[i][PT];
865                p[i][PT] = p[j][PT];
866                p[j][PT] = temp;
867
868                temp = p[i][AT];
869                p[i][AT] = p[j][AT];
870                p[j][AT] = temp;
871
872                temp = p[i][BT];
873                p[i][BT] = p[j][BT];
874                p[j][BT] = temp;
875
876                temp = p[i][ET];
877                p[i][ET] = p[j][ET];
878                p[j][ET] = temp;
879
880                temp = p[i][WT];
881                p[i][WT] = p[j][WT];
882                p[j][WT] = temp;
883
884                temp = p[i][TAT];
885                p[i][TAT] = p[j][TAT];
886                p[j][TAT] = temp;
887
888                temp = p[i][CT];
889                p[i][CT] = p[j][CT];
890                p[j][CT] = temp;
891
892                temp = p[i][ST];
893                p[i][ST] = p[j][ST];
894                p[j][ST] = temp;
895
896                temp = p[i][PT];
897                p[i][PT] = p[j][PT];
898                p[j][PT] = temp;
899
900                temp = p[i][AT];
901                p[i][AT] = p[j][AT];
902                p[j][AT] = temp;
903
904                temp = p[i][BT];
905                p[i][BT] = p[j][BT];
906                p[j][BT] = temp;
907
908                temp = p[i][ET];
909                p[i][ET] = p[j][ET];
910                p[j][ET] = temp;
911
912                temp = p[i][WT];
913                p[i][WT] = p[j][WT];
914                p[j][WT] = temp;
915
916                temp = p[i][TAT];
917                p[i][TAT] = p[j][TAT];
918                p[j][TAT] = temp;
919
920                temp = p[i][CT];
921                p[i][CT] = p[j][CT];
922                p[j][CT] = temp;
923
924                temp = p[i][ST];
925                p[i][ST] = p[j][ST];
926                p[j][ST] = temp;
927
928                temp = p[i][PT];
929                p[i][PT] = p[j][PT];
930                p[j][PT] = temp;
931
932                temp = p[i][AT];
933                p[i][AT] = p[j][AT];
934                p[j][AT] = temp;
935
936                temp = p[i][BT];
937                p[i][BT] = p[j][BT];
938                p[j][BT] = temp;
939
940                temp = p[i][ET];
941                p[i][ET] = p[j][ET];
942                p[j][ET] = temp;
943
944                temp = p[i][WT];
945                p[i][WT] = p[j][WT];
946                p[j][WT] = temp;
947
948                temp = p[i][TAT];
949                p[i][TAT] = p[j][TAT];
950                p[j][TAT] = temp;
951
952                temp = p[i][CT];
953                p[i][CT] = p[j][CT];
954                p[j][CT] = temp;
955
956                temp = p[i][ST];
957                p[i][ST] = p[j][ST];
958                p[j][ST] = temp;
959
960                temp = p[i][PT];
961                p[i][PT] = p[j][PT];
962                p[j][PT] = temp;
963
964                temp = p[i][AT];
965                p[i][AT] = p[j][AT];
966                p[j][AT] = temp;
967
968                temp = p[i][BT];
969                p[i][BT] = p[j][BT];
970                p[j][BT] = temp;
971
972                temp = p[i][ET];
973                p[i][ET] = p[j][ET];
974                p[j][ET] = temp;
975
976                temp = p[i][WT];
977                p[i][WT] = p[j][WT];
978                p[j][WT] = temp;
979
980                temp = p[i][TAT];
981                p[i][TAT] = p[j][TAT];
982                p[j][TAT] = temp;
983
984                temp = p[i][CT];
985                p[i][CT] = p[j][CT];
986                p[j][CT] = temp;
987
988                temp = p[i][ST];
989                p[i][ST] = p[j][ST];
990                p[j][ST] = temp;
991
992                temp = p[i][PT];
993                p[i][PT] = p[j][PT];
994                p[j][PT] = temp;
995
996                temp = p[i][AT];
997                p[i][AT] = p[j][AT];
998                p[j][AT] = temp;
999
1000               temp = p[i][BT];
1001               p[i][BT] = p[j][BT];
1002               p[j][BT] = temp;
1003
1004               temp = p[i][ET];
1005               p[i][ET] = p[j][ET];
1006               p[j][ET] = temp;
1007
1008               temp = p[i][WT];
1009               p[i][WT] = p[j][WT];
1010               p[j][WT] = temp;
1011
1012               temp = p[i][TAT];
1013               p[i][TAT] = p[j][TAT];
1014               p[j][TAT] = temp;
1015
1016               temp = p[i][CT];
1017               p[i][CT] = p[j][CT];
1018               p[j][CT] = temp;
1019
1020               temp = p[i][ST];
1021               p[i][ST] = p[j][ST];
1022               p[j][ST] = temp;
1023
1024               temp = p[i][PT];
1025               p[i][PT] = p[j][PT];
1026               p[j][PT] = temp;
1027
1028               temp = p[i][AT];
1029               p[i][AT] = p[j][AT];
1030               p[j][AT] = temp;
1031
1032               temp = p[i][BT];
1033               p[i][BT] = p[j][BT];
1034               p[j][BT] = temp;
1035
1036               temp = p[i][ET];
1037               p[i][ET] = p[j][ET];
1038               p[j][ET] = temp;
1039
1040               temp = p[i][WT];
1041               p[i][WT] = p[j][WT];
1042               p[j][WT] = temp;
1043
1044               temp = p[i][TAT];
1045               p[i][TAT] = p[j][TAT];
1046               p[j][TAT] = temp;
1047
1048               temp = p[i][CT];
1049               p[i][CT] = p[j][CT];
1050               p[j][CT] = temp;
1051
1052               temp = p[i][ST];
1053               p[i][ST] = p[j][ST];
1054               p[j][ST] = temp;
1055
1056               temp = p[i][PT];
1057               p[i][PT] = p[j][PT];
1058               p[j][PT] = temp;
1059
1060               temp = p[i][AT];
1061               p[i][AT] = p[j][AT];
1062               p[j][AT] = temp;
1063
1064               temp = p[i][BT];
1065               p[i][BT] = p[j][BT];
1066               p[j][BT] = temp;
1067
1068               temp = p[i][ET];
1069               p[i][ET] = p[j][ET];
1070               p[j][ET] = temp;
1071
1072               temp = p[i][WT];
1073               p[i][WT] = p[j][WT];
1074               p[j][WT] = temp;
1075
1076               temp = p[i][TAT];
1077               p[i][TAT] = p[j][TAT];
1078               p[j][TAT] = temp;
1079
1080               temp = p[i][CT];
1081               p[i][CT] = p[j][CT];
1082               p[j][CT] = temp;
1083
1084               temp = p[i][ST];
1085               p[i][ST] = p[j][ST];
1086               p[j][ST] = temp;
1087
1088               temp = p[i][PT];
1089               p[i][PT] = p[j][PT];
1090               p[j][PT] = temp;
1091
1092               temp = p[i][AT];
1093               p[i][AT] = p[j][AT];
1094               p[j][AT] = temp;
1095
1096               temp = p[i][BT];
1097               p[i][BT] = p[j][BT];
1098               p[j][BT] = temp;
1099
1100               temp = p[i][ET];
1101               p[i][ET] = p[j][ET];
1102               p[j][ET] = temp;
1103
1104               temp = p[i][WT];
1105               p[i][WT] = p[j][WT];
1106               p[j][WT] = temp;
1107
1108               temp = p[i][TAT];
1109               p[i][TAT] = p[j][TAT];
1110               p[j][TAT] = temp;
1111
1112               temp = p[i][CT];
1113               p[i][CT] = p[j][CT];
1114               p[j][CT] = temp;
1115
1116               temp = p[i][ST];
1117               p[i][ST] = p[j][ST];
1118               p[j][ST] = temp;
1119
1120               temp = p[i][PT];
1121               p[i][PT] = p[j][PT];
1122               p[j][PT] = temp;
1123
1124               temp = p[i][AT];
1125               p[i][AT] = p[j][AT];
1126               p[j][AT] = temp;
1127
1128               temp = p[i
```



```
90 //Wait Time and Turn Around Time Calculation
91 for(int i = 0; i<n; i++){
92     p[i][WT] = p[i][ET] - p[i][BT] - p[i][AT] ;
93     p[i][TAT] = p[i][WT] + p[i][BT];
94
95     avgwt += p[i][WT];
96     avgtat += p[i][TAT];
97 }
98 avgwt /= n;
99 avgtat /= n;
100
101 }
102 int main(){
103     int n;
104     printf("Enter the total number of jobs\n");
105     scanf("%d", &n);
106     float processes[n][10];
107
108     get_input(n, processes);
109     init_entries(n, processes);
110     print_array(n, processes);
111     sort_array(n, processes);
112     sort_arrayAT(n, processes);
113     calculate(n, processes);
114
115     get_input(n, processes);
116     init_entries(n, processes);
117     print_array(n, processes);
118     sort_array(n, processes);
119     sort_arrayAT(n, processes);
120     calculate(n, processes);
121     print_array(n, processes);
122     return 0;
123 }
```

Output:

```
ali@Ubuntu22: ~/Desktop/OS Lab/Lab10
ali@Ubuntu22:~/Desktop/OS Lab/Lab10$ gcc t2.c -o t2.o
ali@Ubuntu22:~/Desktop/OS Lab/Lab10$ ./t2.o
Enter the total number of jobs
5
Enter process 1 arrival time
8
Enter process 1 burst time
3
Enter process 2 arrival time
9
Enter process 2 burst time
4
Enter process 3 arrival time
7
Enter process 3 burst time
2
Enter process 4 arrival time
8
Enter process 4 burst time
3
Enter process 5 arrival time
1
Enter process 5 burst time
6
Process Job Number:   Arrival time   burst time:   End time:     Wait time:    TurnAround time
-----1.0-----   ----8.0-----   ----3.0-----   ----0.0-----   ----0.0-----   ----0.0-----
-----2.0-----   ----9.0-----   ----4.0-----   ----0.0-----   ----0.0-----   ----0.0-----
-----3.0-----   ----7.0-----   ----2.0-----   ----0.0-----   ----0.0-----   ----0.0-----
-----4.0-----   ----8.0-----   ----3.0-----   ----0.0-----   ----0.0-----   ----0.0-----
-----5.0-----   ----1.0-----   ----6.0-----   ----0.0-----   ----0.0-----   ----0.0-----
Process Job Number:   Arrival time   burst time:   End time:     Wait time:    TurnAround time
-----5.0-----   ----1.0-----   ----6.0-----   ----7.0-----   ----0.0-----   ----6.0-----
-----3.0-----   ----7.0-----   ----2.0-----   ----9.0-----   ----0.0-----   ----2.0-----
-----4.0-----   ----8.0-----   ----3.0-----   ----12.0-----   ----1.0-----   ----4.0-----
-----1.0-----   ----8.0-----   ----3.0-----   ----15.0-----   ----4.0-----   ----7.0-----
-----2.0-----   ----9.0-----   ----4.0-----   ----19.0-----   ----6.0-----   ----10.0-----
ali@Ubuntu22:~/Desktop/OS Lab/Lab10$
```

DESCRIPTION:

The SJF algorithm also can be implemented as FCFS, but on this, the jobs are sorted by their burst time. A job with the shortest burst time will be scheduled first i.e. sorting should be done from short to large time of burst time. Take arrival time also into consideration. This is the SJF Non-pre-emptive algorithm. While implementing Priority scheduling we have read the priority also and they should be sorted by highest priority to lowest priority.

It maintains the Ready queue in order of increasing job lengths. When a job comes in, insert it in the ready queue based on its length. When the current process is done, pick the one at the head of the queue and run it.