# Scilab Manual for Operating Systems Lab by Dr Maheswari R Computer Engineering VIT CHENNAI[1]

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# Experiment: 1

# First Come First Serve Non pre-emptive CPU Scheduling using Scilab

check Appendix AP 18 for dependency:

`fcfs.sci`

**Scilab code Solution 1.0** First Come First Serve Non Preemptive CPU Scheduling using Scilab

```
1 clear;
2 clc;
3 //WINDOWS 10 64-BIT OS , Scilab and toolbox versions
      6.1.0.
4
5 //Scheduling is a matter of managing queues and to
     decide which of the process have to be executed
     next to achieve high efficiency level.
6 //First Come First Serve (FCFS) Non Pre-emptive :
     Jobs are always executed on a first-come, first-
     serve basis.
```

```
7
8  //Functions to be loaded
9  exec("fcfs.sci");// fcfs.sci dependency file
10
11
12      num=4; //no of processes P1,P2,P3,P4
13
14      bt=[10 2 8 6]; //Sample burst time
15      wt=zeros(1,num); //waiting time
16      tat=zeros(1,num); //turn around time
17
18      disp("First Come First Serve (FCFS) Non Pre-
           emptive CPU Scheduling");
19      disp("Burst time of the given Process P1=10, P2
           =2, P3=8, P4=6");
20
21 disp('Waiting Time of each Process'); //displaying
     the waiting time
22
23 fcfs = firstcomefirstserve(num,bt,wt,tat)     //
     Calling first come first serve function
```

# Experiment: 2

# Shortest Job First (SJF) Pre-emptive CPU Scheduling using Scilab

check Appendix AP 17 for dependency:

```
display_sjf_new.sci
```

**Scilab code Solution 2.0** Shortest Job First

```
1 clear;
2 clc;
3
4 //WINDOWS 10 64-BIT OS , Scilab and toolbox versions
      6.1.0.
5
6 //SJF scheduling is employed when several processes
    arrive almost at the same time, so as to avoid
    conflict, ensure maximum CPU utilization with
    minimum waiting time, turnaround time to minimize
     starvation. The algorthm can be used for both
```

```
    cases i.e., when arrival time is the same for all
     or most processes and when there are slightly
    different arrival times. In case of same arrival
    time, the values amy be set to 0 by default by
    the user
7
8  // loading the necessary functions
9
10 exec("sjf_new.sci");
11 exec("display_sjf_new.sci");
12
13 num=4;           //no of processes P1,P2,P3,P4
14 pt=[10 2 8 6 ];    //process time or burst time
15 pid=[1 2 3 4];  //process id
16 wt=zeros(1,num);    //waiting time
17 tat=zeros(1,num);  //turn around time
18 total=0;          //total waiting time
19 total2=0;             //total turn around time
20
21 disp("Shortest Job First(SJF) Pre-emptive CPU
    Scheduling");
22 disp("Burst time of the given Process P1=10, P2=2,
    P3=8, P4=6");
23
24
25 disp("Sorted Process based on its Shortest Job");
26
27 sjf = shorestjobfirst(pid,num,pt,wt,tat);     //
    Calling shorest job first function
```

---

check Appendix AP 16 for dependency:

`sjf_new.sci`

# Experiment: 3

# Graphical Analysis with Waiting time & Average waiting time of CPU Scheduling Algorithms using Scilab

check Appendix AP 15 for dependency:

`fcfs_wt_awt.sci`

**Scilab code Solution 3.0** Graphical Analysis WT and AWT

```
1 clear;
2 clc;
3 //WINDOWS 10 64-BIT OS , Scilab and toolbox versions
      6.1.0.
4
```

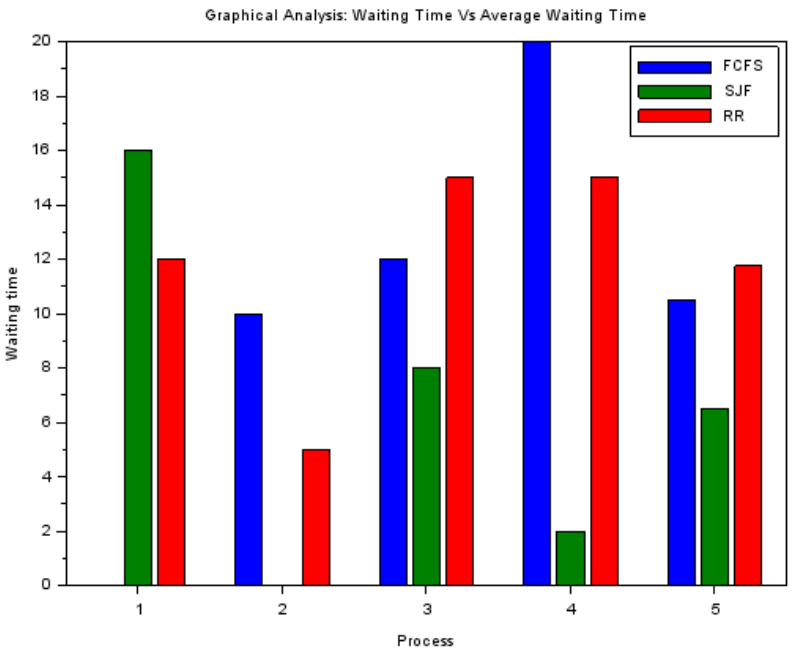



Figure 3.1: Graphical Analysis WT and AWT

```
5  //Scheduling algorithms deals to minimize queuing
       delay and to optimize performance of queuing
       environment. In this analysis, some common
       scheduling algorithms like First Come First Serve
        (FCFS), Shortest Job First (SJF) and Round Robin
        (RR) Scheduling are studied and reviewed on the
       basis of their working strategy
6
7
8  //Functions to be loaded
9  exec("fcfs_wt_awt.sci"); // fcfs_wt_awt.sci
       dependency file
10 exec("sjf_wt_awt.sci"); // sjf_wt_awt.sci dependency
        file
11 exec("rr_wt_awt.sci");  // rr_wt_awt.sci dependency
       file
12
13     num=4; //no of processes P1,P2,P3,P4
14     bt=[10 2 8 6]; //Sample burst time
15     wt=zeros(1,num); //waiting time
16     tat=zeros(1,num); //turn around time
17
18 disp("Graphical Analysis- Waiting Time vs Average
       Waiting Time of Scheduling Algorithms");
19
20 disp("Burst time of the given Process P1=10, P2=2,
       P3=8, P4=6");
21
22 disp('Waiting Time of each Process in FCFS'); //
       displaying the waiting time in FCFS
23
24 fcfs = firstcomefirstserve(num,bt,wt,tat)     //
       Calling first come first serve function
25
26
27 disp('Waiting time of each Process in SJF'); //
       displaying the Waiting time of each Process in
       SJF
```

```
28 sjf = shortestjobfirst(num,bt,wt,tat)     // Calling
      shortest job first function
29
30
31 disp('Waiting Time of each Process in Round Robin');
      //displaying the Waititing Time of each Process
      in Round Robin
32
33 rr= roundrobin(num,bt,wt,tat)              // Calling
      Round Robin function
34
35 /*constructing a rows for graphical representation*/
36
37 scf(1);
38
39 y = [0,10,20,30,40];
40
41 x=[1,2,3,4,5]
42 avg =
      [0,16,12;10,0,5;12,8,15;20,2,15;10.5,6.5,11.75];
43
44 /*Matrix avg is set of values obtained from waiting
      time for each algorithm FCFS, SJF, RR
      respectively*/
45
46 xtitle('Graphical Analysis: Waiting Time Vs Average
      Waiting Time','Process','Waiting time');
47
48 bar(x,avg);
49
50 legend("FCFS","SJF","RR");
```

---

check Appendix AP 14 for dependency:

`rr_wt_awt.sci`

check Appendix AP 13 for dependency:

`sjf_wt_awt.sci`

# Experiment: 4

# Graphical Analysis with turn-around time & Average turnaround time of CPU Scheduling Algorithms using Scilab

check Appendix AP 12 for dependency:

```
fcfs_tat_atat.sci
```

**Scilab code Solution 4.0** Analysis TAT and ATAT

```
1 clear;
2 clc;
3 //WINDOWS 10 64-BIT OS , Scilab and toolbox versions
      6.1.0.
4
```

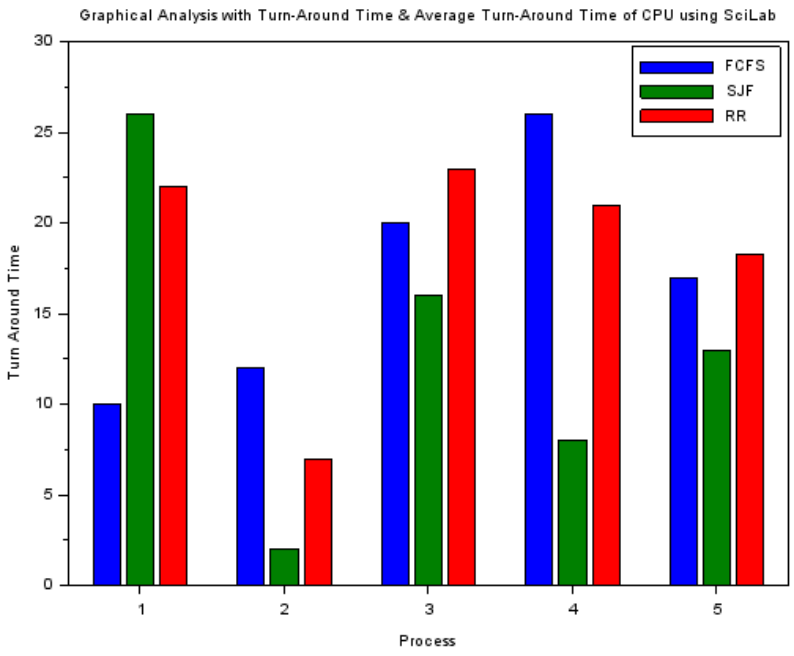



Figure 4.1: Analysis TAT and ATAT

```
5  //In this analysis, some common scheduling
       algorithms like First Come First Serve (FCFS),
       Shortest Job First (SJF) and Round Robin (RR)
       Scheduling are studied and reviewed on the basis
       of their Turn Around Time and Average Turn Around
        Time
6
7
8  //Functions to be loaded
9  exec("fcfs_tat_atat.sci"); // fcfs_tat_atat.sci
       dependency file for FCFS Scheduling
10 exec("sjf_tat_atat.sci"); // sjf_tat_atat.sci
       dependency file for SJF Scheduling
11 exec("rr_tat_atat.sci");  // rr_tat_atat.sci
       dependency file for RR Scheduling
12
13     num=4; //no of processes P1,P2,P3,P4
14     bt=[10 2 8 6]; //Sample burst time
15     wt=zeros(1,num); //waiting time
16     tat=zeros(1,num); //turn around time
17
18 disp("Graphical Analysis with Turn-Around Time &
       Average Turn-Around Time of CPU using SciLab");
19 disp("Burst time of the given Process P1=10, P2=2,
       P3=8, P4=6");
20
21 disp('Turn Around Time of each Process in FCFS'); //
       displaying the Turn Around time in FCFS
22
23 fcfs = firstcomefirstserve(num,bt,wt,tat)     //
       Calling first come first serve function
24
25
26 disp('Turn Around Time of each Process in SJF'); //
       displaying the Turn Around time of each Process
       in SJF
27 sjf = shortestjobfirst(num,bt,wt,tat)     // Calling
       shortest job first function
```

```
28
29
30 disp('Turn Around Time of each Process in Round
      Robin'); //displaying the Turn Around Time of
      each Process in Round Robin
31
32 rr= roundrobin(num,bt,wt,tat)              // Calling
      Round Robin function
33
34 /*constructing a rows for graphical representation*/
35
36 scf(1);
37
38 y = [0,10,20,30,40];
39
40 x=[1,2,3,4,5]
41 avg =
      [10,26,22;12,2,7;20,16,23;26,8,21;17,13,18.25];
42
43 /*Matrix avg is set of values obtained from Turn
      Around time for each algorithm FCFS, SJF, RR
      respectively*/
44
45 xtitle('Graphical Analysis with Turn-Around Time &
      Average Turn-Around Time of CPU using SciLab',"
      Process","Turn Around Time");
46
47
48 bar(x,avg);
49
50 legend("FCFS","SJF","RR");
```

check Appendix AP 11 for dependency:

`rr_tat_atat.sci`

check Appendix AP 10 for dependency:

`sjf_tat_atat.sci`

# Experiment: 5

# Round Robin (RR) Pre-emptive CPU Scheduling using Scilab

check Appendix AP 9 for dependency:

```
display_rr.sci
```

**Scilab code Solution 5.0** Round Robin Scheduling

```
1 clear;
2 clc;
3
4 //WINDOWS 10 64-BIT OS , Scilab and toolbox versions
      6.1.0.
5
6 // Round Robin (RR) is a pre-emptive scheduling
     algorithm. The CPU is shifted to the next process
      after fixed interval time, which is called time
     quantum/time slice.
7
```

```
8  //Functions to be loaded
9  exec("roundrobin_new.sci");//dependency file
       roundrobin_new.sci
10 exec("display_rr.sci");//dependency file for display
       function
11
12 disp("                        ROUND ROBIN SCHEDULING
                ")
13
14 at = [0 1 2 3];    // Defining sample Arrival Time
15 bt = [9 5 3 4];    // Defining sample Burst Time
16 n=size(at);
17
18 disp(" Sample Quantum Time= 5 ")
19 mprintf("\n")
20 q = input("Enter Quantum Time: ");
21 disp("Process                  Turnaround time
                Waiting time");
22
23 //Calling Round Robin function
24 rr = roundrobin(q,n,at,bt);
25
26 //disp("Process                  Turnaround time
                Waiting time");
```

---

check Appendix AP 8 for dependency:

`roundrobin_new.sci`

# Experiment: 6

# Comparison of Various Partition Allocation Algorithms using Scilab

check Appendix AP 5 for dependency:

`best_fit_func.sci`

check Appendix AP 4 for dependency:

`display_func.sci`

check Appendix AP 3 for dependency:

`first_fit_func.sci`

**Scilab code Solution 6.0** Comparison of Various Partition Allocation Algorithms using Scilab

```
1 clear;
```

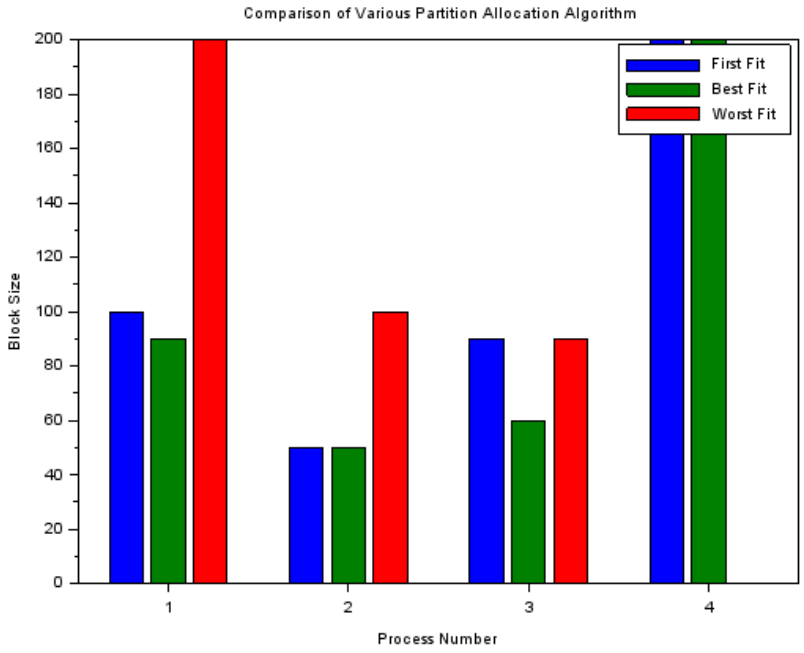



Figure 6.1: Comparison of Various Partition Allocation Algorithms using Scilab

```
2  clc;
3  //WINDOWS 10 64-BIT OS , Scilab and toolbox versions
       6.1.0.
4
5  //This experiment is compare the various partition
       allocation algorithms used by the operating
       system for memory allocation
6  //     1. First-Fit Memory Allocation  2. Best-Fit
       Memory Allocation 3. Worst-Fit Memory Allocation
7
8  // loading all the necessary functions
9  exec("first_fit_func.sci");
10 exec("best_fit_func.sci");
11 exec("worst_fit_func.sci");
12 exec("display_func.sci");
13
14 // Example problem
15 p = [90 20 50 200];// Defining sample Process Size
16 b = [50 100 90 200 60];// Defining sample Block Size
17
18
19 //Determining the number of processes and blocks
20
21 size_process = size(p);      // Size of the process
       array is calculated using size() function
22 size_process = size_process(2);
23
24 size_block = size(b);        // Size of the block
       array is calculated using size() function
25 size_block = size_block(2);
26
27 /*calling the function, defined in first fit.sci,
       for first fit allocation*/
28 ff_allot = firstFit(p,b,size_process,size_block)
29
30 /*calling the function, defined in best fit.sci, for
       best fit allocation*/
31 bf_allot = bestFit(p, b, size_process, size_block)
```

```
32
33 /*calling the function, defined in worst fit.sci,
      for worst fit allocation*/
34 wf_allot = worstFit(p,b,size_process,size_block);
35
36
37 ff_allotsize = zeros(1,size_process);   //
      ff_allotsize - size of the selected blocks for
      first fit
38 bf_allotsize = zeros(1,size_process);   //
      bf_allotsize - size of the selected blocks for
      best fit
39 wf_allotsize = zeros(1,size_process);   //
      wf_allotsize - size of the selected blocks for
      worst fit
40
41 // storing the allocated block size for each process
       according to the respective fits
42
43 for i=1:size_process
44     if ff_allot(i)~=0 then                          //
         checking if any block is selected
45         ff_allotsize(i) = b(ff_allot(i));          //
             storing the size of the selected block
             for first fit
46     else
47         ff_allotsize(i) = 0                        //
             store size as 0 if no block is selected
48     end,
49
50     if bf_allot(i)~=0 then                          //
         checking if any block is selected
51         bf_allotsize(i) = b(bf_allot(i));          //
             storing the size of the selected block
             for best fit
52     else
53         bf_allotsize(i) = 0                        //
             store size as 0 if no block is selected
```

```
54      end,
55
56      if wf_allot(i)~=0 then                          //
           checking if any block is selected
57          wf_allotsize(i) = b(wf_allot(i));           //
              storing the size of the selected block
              for worst fit
58      else
59          wf_allotsize(i) = 0;                        //
              store size as 0 if no block is selected
60      end,
61  end
62
63
64  //constructing a matrix(y) for graphical
       representation of first fit, best fit and worst
       fit
65
66  y= zeros(size_process,3);
67
68  y(:,1) = ff_allotsize;        //  First fit allotment
       size
69  y(:,2) = bf_allotsize;        //  Best fit allotment
       size
70  y(:,3) = wf_allotsize;        //  Worst fit allotment
       size
71
72  bar(y) // plotting a bar graph
73
74  xtitle("Comparison of Various Partition Allocation
       Algorithm","Process Number","Block Size");
75  legend("First Fit" , "Best Fit", "Worst Fit" );
76
77
78  //printing first fit, best fit and worst fit array
79
80  mprintf("Comparison of Various Partition Allocation
       Algorithms using Scilab\n\n")    //displaying the
```

```
    title of experiment
81 mprintf("Ex: Process size P1=90, P2=20, P3=50, P4
   =200");                                  //displaying
   the sample Process size considered for the of
   experiment
82 mprintf("\n    Block or hole size B1= 50, B2= 100,
   B3=90, B4=200\n");                       //displaying
   the sample Block size considered for the of
   experiment
83
84 mprintf("\nFIRST FIT:\n")
85 mprintf("Process no. \tProcess size\tBlock no. Block
    size\n")
86 display(ff_allot,ff_allotsize,size_process,p)
            //displaying the process and block
   allocation by first fit array
87
88 mprintf("\nBEST FIT:\n")
89 mprintf("Process no. \tProcess size\tBlock no. Block
    size\n")
90 display(bf_allot,bf_allotsize,size_process,p)
              //displaying the process and block
   allocation by best fit array
91
92
93 mprintf("\nWORST FIT:\n")
94 mprintf("Process no. \tProcess size\tBlock no. Block
    size\n")
95 display(wf_allot,wf_allotsize,size_process,p)
              //displaying the process and block
   allocation by worst fit array
```

---

check Appendix AP 2 for dependency:

`worst_fit_func.sci`

# Experiment: 7

# Deadlock Avoidance using Scilab

check Appendix AP 7 for dependency:

```
Deadlock.sci
```

**Scilab code Solution 7.0** Banker Algorithm Deadlock Avoidance using Scilab

```
1 clear;
2 clc;
3
4 //The bankers algorithm is a resource allocation
    and deadlock avoidance algorithm that tests for
    safety by simulating the allocation for
    predetermined maximum possible amounts of all
    resources
5
6 // Load dependency file
7 exec("Deadlock.sci");
8
```

```
9  //WINDOWS 10 64-BIT OS , Scilab and toolbox versions
       6.1.0.
10 close;
11 n=5; // Number of processes
12 m=3; // Number of resources
13
14
15 disp("Bankers Algorithm for Deadlock Avoidance")
16 mprintf("\nConsider Number of Processes N=5,Number
       of resources M=3\n"); // Number of processes and
       Number of resources
17
18 mprintf("\n Allocation are []0 1 0;2 0 0;3 0 2;2 1
       2;0 0 2]"); // Giving the process allocation
       values
19 mprintf("\nM=[7 5 3;3 2 2;9 0 2;2 2 2;4 3 3]\n"); //
       Giving the maximum values
20
21 disp('Following is the SAFE Sequence satisfies the
       safety requirement:'); // Disp command prints the
       safe sequence
22
23 Deadlock(n,m)  // Function call of Deadlock -
       Bankers Algorithm
```

# Experiment: 8

# Process Synchronization Techniques using Scilab

check Appendix AP 6 for dependency:

`Process_Synch.sci`

**Scilab code Solution 8.0** Dekker Process Synchronization Techniques using Scilab

```
1  ////DEKKER'S ALGORITHM////
2
3  clear;
4  clc;
5  //WINDOWS 10 64-BIT OS , Scilab and toolbox versions
       6.1.0.
6
7  exec("Process_Synch.sci");
8
9
10 //Dekker's algorithm guarantees mutual exclusion,
     freedom from deadlock, and freedom from
     starvation.
```

```
11 //In this algorithm, the position of each process is
       indicated with the variables turn and flag.
12
13
14 //INITIALIZING THE VALUES
15 c1=1,c2=1,turn=1;
16 count0=0,count1=0,count=0;
17 i=0;
18 //Deafult values
19 limit=10;    //Limit of CS
20 a=1,b=1;     //Time taken in CS by both process
21
22
23 disp("Process Synchronization using Dekkers
      Algorithm in Scilab");
24 mprintf("\nInput Ex: Time in CS for P1 is 2, P2 is
      3, Total Time is 9\n ")
25 //INSTRUCTIONS TO PROCEED :
26 mprintf("  1) Process 1 enters \n");
27 mprintf("  2) Process 2 enters \n");
28 mprintf("  3) Both process enters \n");
29 mprintf("  4) Exit \n");
30 mprintf("\n Enter total time requied by Process 1 in
       CS:")
31 a = input(" ")
32 mprintf(" Enter total time requied by Process 2 in
      CS:")
33 b = input(" ")
34 mprintf(" Enter total time limit of CS :")
35 limit = input(" ")
36 //Psyn(a,b,limit);
37 Psyn(a,b,limit)
38 //FUNCTION TO IDENTIFY WHICH PROCESS ENTERS NOW
```

# Experiment: 9

# Memory Management using Scilab

check Appendix AP 5 for dependency:

`best_fit_func.sci`

check Appendix AP 4 for dependency:

`display_func.sci`

check Appendix AP 3 for dependency:

`first_fit_func.sci`

**Scilab code Solution 9.0** Memory Management using Scilab First Fit Best Fit and Worst Fit

```
1 clear;
```

```
2  clc;
3  //WINDOWS 10 64-BIT OS , Scilab and toolbox versions
       6.1.0.
4  //The memory to the processor will be allocated in
       several blocks of memory, in order to make a
       perfectly organized allocation between the memory
        blocks and process, three different partition
       and allocation algorithms are used 1. First-Fit
       Memory Allocation  2. Best-Fit Memory Allocation
       3. Worst-Fit Memory Allocation
5
6  /* loading all the necessary functions */
7  exec("first_fit_func.sci");
8  exec("best_fit_func.sci");
9  exec("worst_fit_func.sci");
10 exec("display_func.sci");
11
12 mprintf("Memory Management First fit, Best Fit and
       Worst Fit Allocation\n ");
13 mprintf("
       ------------------------------------------------------------------------\
       n ");
14
15 mprintf("Ex: Process size P1=212, P2=417, P3=112, P4
       =426");
16 mprintf("\n    Block or hole size B1= 100, B2= 500,
       B3=200, B4=300, B5=600\n");
17
18 /* Example problem */
19 p = [212,417,112,426];// process size
20 b = [100,500,200,300,600];// block or hole size
21
22 disp("Select the Option:");
23 mprintf(" 1-First Fit\n");
24 mprintf(" 2-Best Fit \n")
25 mprintf(" 3-Worst Fit \n");
26
27 /*
```

```
28 Determining the number of processes and blocks
29 */
30 size_process = size(p);
31 size_process = size_process(2);
32
33 size_block = size(b);
34 size_block = size_block(2);
35
36 n1=input("");
37 if(n1==1) then
38 //     firstfit();
39 /*calling the function, defined in first fit.sci,
      for first fit allocation*/
40     ff_allot = firstFit(p,b,size_process,size_block)
41 end
42 if(n1==2) then
43 /*calling the function, defined in best fit.sci, for
     best fit allocation*/
44     bf_allot = bestFit(p, b, size_process,
         size_block)
45
46 end
47 if(n1==3) then
48 //     worstfit();
49 /*calling the function, defined in worst fit.sci,
      for worst fit allocation*/
50 wf_allot = worstFit(p,b,size_process,size_block);
51
52 end
53
54 /*
55 ff_allotsize - size of the selected blocks for first
     fit
56 bf_allotsize - size of the selected blocks for best
     fit
57 wf_allotsize - size of the selected blocks for worst
     fit
58 */
```

```
59 ff_allotsize = zeros(1,size_process);
60 bf_allotsize = zeros(1,size_process);
61 wf_allotsize = zeros(1,size_process);
62
63 /* storing the allocated block size for each process
       according to the respective fits */
64 for i=1:size_process
65     if(n1==1) then
66
67         if ff_allot(i)~=0 then // checking if any
               block is selected
68             ff_allotsize(i) = b(ff_allot(i)); //
                   storing the size of the selected
                   block for first fit
69         else
70             ff_allotsize(i) = 0 // store size as 0
                   if no block is selected
71         end,
72     end
73
74     if(n1==2) then
75         if bf_allot(i)~=0 then // checking if any
               block is selected
76             bf_allotsize(i) = b(bf_allot(i)); //
                   storing the size of the selected
                   block for best fit
77         else
78             bf_allotsize(i) = 0 // store size as 0
                   if no block is selected
79         end,
80     end
81     if(n1==3) then
82         if wf_allot(i)~=0 then // checking if any
               block is selected
83             wf_allotsize(i) = b(wf_allot(i)); //
                   storing the size of the selected
                   block for worst fit
84         else
```

```
85              wf_allotsize(i) = 0; // store size as 0
                    if no block is selected
86          end,
87      end
88  end
89  /*
90  printing first fit, best fit and worst fit array
91  */
92  if(n1==1) then
93  mprintf("\nFIRST FIT:\n")
94  mprintf("Process no. \tProcess size\tBlock no. Block
        size\n")
95      display(ff_allot,ff_allotsize,size_process,p)
96  end
97  if(n1==2) then
98
99      mprintf("\nBEST FIT:\n")
100     mprintf("Process no. \tProcess size\tBlock no.
            Block size\n")
101     display(bf_allot,bf_allotsize,size_process,p)
102 end
103 if(n1==3) then
104
105     mprintf("\nWORST FIT:\n")
106     mprintf("Process no. \tProcess size\tBlock no.
            Block size\n")
107     display(wf_allot,wf_allotsize,size_process,p)
108 end
```

---

check Appendix AP 2 for dependency:

worst_fit_func.sci

# Experiment: 10

# Page Replacement Algorithm using Scilab

check Appendix AP 1 for dependency:

```
PageReplacement.sci
```

**Scilab code Solution 10.0** Optimal Page Replacement Algorithm using Scilab

```
1 clear;
2 clc;
3 //WINDOWS 10 64-BIT OS , Scilab and toolbox versions
      6.1.0.
4
5 //   In Optimal page replacement algorithm, the page
      that will not be used for the longest period of
     time is replaced to make space for the requested
     page.
6
7 //Functions to be loaded
```

```
8  exec("PageReplacement.sci"); // PageReplacement.sci
     dependency file
9
10 mprintf(" Optimal Page Replacement Algorithm using
     Scilab\n")
11
12 mprintf(" Sample Input: No. of frames=4, No. Page=13
     ")
13 mprintf("\n")
14 mprintf("Sample Page Reference String
     7,0,1,2,0,3,0,4,2,3,0,3,2")
15 frames=cell(10);  //Read Frames
16 pages=cell(30);   //Read Pages
17 temp=cell(10);    //Read temp
18 noOfFrames=0;
19 noOfPages=0;
20
21 mprintf("\n")
22 mprintf('Enter No Of Frames');  //Write to command
     window
23 mprintf("\n")
24 noOfFrames=input("");  // Giving the no.of.Frames
     Value
25
26 mprintf('Enter No Of Pages');   //Write to command
     window
27 noOfPages=input("");   // Giving the no.of.Pages
     Value
28 flag1=0;   //Setting a Flag
29 flag2=0;   //Setting a Flag
30 flag3=0;   //Setting a Flag
31 faults=0;  //Read faults
32 maximum=0;  //Setting it to a marker value
33
34 mprintf("\n")
35 mprintf('Enter Page Reference Values');  //Write to
     command window
36
```

```
37 for n=1:noOfPages //Giving the first reference value
       in first frame
38     // mprintf("Enter Page reference %d",n)
39      pages{n}=input("");  //Printing the value in
          page
40 end
41
42 pagereplacement(noOfFrames,noOfPages,pages)     //
     Calling pagereplacement function
```

# Appendix

**Scilab code AP 1**

```
function []= pagereplacement(noOfFrames,noOfPages
   ,pages)  ////Page replacement function

for n=1:noOfFrames //Giving the no.of Frames
    frames{n}=-1;
end

for i=1:noOfPages   // No. of Pages
    flag1=0;
    flag2=0;
        for j=1:noOfFrames
        if(frames{j}==pages{i})
            flag1=1;
            flag2=1;
            break;
        end
    end
    if(flag1==0)
        for j=1:noOfFrames
            if(frames{j}==-1)
                faults=faults+1;
                frames{j}=pages{i};
                flag2=1;
                break;
            end
        end
```

```
26      end
27      if(flag2==0)
28          flag3=0;
29          for j=1:noOfFrames
30              temp{j}=-1;
31              for k=i+1:noOfPages
32                  if(frames{j}==pages{k}) //Check the
                       frames and pages are filled
33                      temp{j}=k
34                      break;
35                  end
36              end
37          end
38
39      //For loop for identifying page faults
40          for j=1:noOfFrames
41              if(temp{j}==-1)
42                  pos=j;
43                  flag3=1;
44                  break;
45              end
46          end
47          if(flag3==0)
48              maximum=temp{0};
49              pos=0;
50              for j=1:noOfFrames
51                  if(temp{j}>maximum)
52                      maximum=temp{j}; //Check the
                           value is long period use or
                           not
53                      pos=j;
54                  end
55              end
56          end
57          frames{pos}=pages{i}
58          faults=faults+1;  //Check next value is
               Equal or to change the position
59      end
```

```
60 end
61 faults=faults-1;
62 mprintf("No Of Page Faluts %d\n",faults);  //Write
   Page Faults to command window
63
64 endfunction
```

Optimal page replacement

**Scilab code AP 2**

```
1 //Worst-Fit Memory Allocation, the operating
   system searches the entire list and allocates the
    largest available hole to the process.
2 //If a large process comes at a later stage, then
   memory may not have space to accommodate it.
3
4 function [wf_allot]=worstFit(p,b,size_process,
   size_block)
5
6 // Declaring worst fit flag array(wf_flag) which is
   used for maintaining the status of each block(
   free or busy)
7
8     wf_allot = zeros(1,size_process);
         // Declaring worst fit array(wf_allot)
9     wf_flag = zeros(1,size_block);
10
11 //For loop for allocating blocks according to worst
   fit
12
13    for i=1:size_process
14        k = -1;                    // k - index
             position of the largest block which can
             accommodate a process, initially set to
             -1
15        for j=1:size_block
16            if p(i)<=b(j) && wf_flag(j) == 0 then //
                 if process size is less than block
```

```
                size and block is free
17                if k==-1 then
18                    k = j;          // update k with
                          index positioin of the block
19                elseif(b(k)<b(j))   // if there is a
                      larger block which can
                     accommodate the process
20                    k = j; // update k with the
                         index position of the larger
                         block
21                end,
22            end,
23        end
24        if(k==-1)
25            wf_allot(i)=0; // if no block can
                 accomodate the process, set allotted
                 block number as 0
26        else
27            wf_allot(i) = k; // store the selected
                 index in the worst fit array in the
                 index position i(process number)
28            wf_flag(k) = 1; // set the status of the
                  selected block as busy
29        end,
30    end
31 endfunction
```

Worst Fit Memory Allocation

**Scilab code AP 13** //First-Fit Memory Allocation algorithm scans the memory and whenever it finds the first big enough hole to store a process,

```
2 //it stops scanning and loads the process into that
     hole/block.
3
4 function [ff_allot]=firstFit(p,b,size_process,
     size_block)
5
```

```
6
7  //Declaring first fit flag array( ff_flag) which is
       used for maintaining the status of each block(
       free or busy)
8
9      ff_allot = zeros(1,size_process);        //
           Declaring first fit array(ff_allot)
10     ff_flag = zeros(1,size_block);
11
12     // For loop for allocating blocks according to
           first fit
13
14     for i=1:size_process
15         for j=1:size_block
16         if p(i) <= b(j) && ff_flag(j)==0 then
               // if process size is less than block
               size and block is free
17             ff_allot(i) = j;
                   // store index position of the block
                   in ff_allot in the index position i(
                   process number)
18             ff_flag(j) = 1;
                   // set status as busy
19             break
20             end,
21         end
22     end
23 endfunction
```

First Fit Memory Allocation

**Scilab code AP 4**

```
1  //Display Function:It prints all required details
       such as Process no. , Process size, Block no.,
2  //Block size for First Fit, Best Fit and Worst Fit.
3
4  function display(allot,allotsize,size_process,p)
5      for i=1:size_process
```

```
6       if allot(i)==0 then
7               mprintf("P%d\t\t%d\t     Not allocated
                    -\n",i,p(i))              // Display
                    the Process number that could not
                    allocated
8           else
9               mprintf("P%d\t\t%d\t\tB%d\t   %d\n",i,p(i
                    ),allot(i),allotsize(i))   // Display
                    the Process number with allocated
                    Block number
10          end,
11      end
12  endfunction
```

Display Function

**Scilab code AP 15** //Best Fit Memory Allocation, the operating system searches the whole memory according to the size of the given process

```
2  //and allocates it to the smallest hole which is big
       enough to accommodate it.
3
4
5  function [bf_allot]=bestFit(p,b,size_process,
       size_block)
6
7
8  //     declaring best fit flag array(bf_flag) which
       is used for maintaining the status of each block(
       free or busy)
9
10      bf_allot = zeros(1,size_process);            //
            declaring best fit array(bf_allot)
11      bf_flag = zeros(1,size_block);
12
13      // For loop for allocating blocks according to
            best fit
14      for i=1:size_process
```

```
15          k = -1;                              // k -
               index position of the smallest block
               which can accommodate a process,
               initially set to -1
16          for j=1:size_block
17              if p(i)<=b(j) && bf_flag(j) == 0 then //
                    if process size is less than block
                   size and block is free
18                  if k==-1 then
19                      k = j;                   // update k
                           with index position of the
                           block
20                  elseif(b(j)<b(k))            // if there
                       is a smaller block which can
                       accommodate the process
21                      k = j;                   // update k
                           with the index position of
                           the smaller block
22                  end,
23              end,
24          end
25          if(k==-1)
26              bf_allot(i)=0;                   // if no
                   block can accomodate the process, set
                    allotted block number as 0
27          else
28              bf_allot(i) = k;                 // store the
                   selected index in the best fit array
                   in the index position i(process
                   number)
29              bf_flag(k) = 1;                  // set the
                   status of the selected block as busy
30          end,
31      end
32  endfunction
```

Best Fit Memory Allocation

**Scilab code AP 6**

```
1 //In this program Dekkers Algorithm is used,
   to ensure one process enters the critical section
    at a time while the other processes need to wait
    for the first one to leave the critical section.
2
3 function [] = Psyn(a,b,limit)
4 while (i<=limit)
5     printf("\n")
6     x = input("SELECT THE OPTION : ")
7
8     //PROCESS 1 ENTERS
9     if x==1 then       // Option 1
10        c1=0;
11           while c2==0
12               if turn==2 then
13                   c1=1;
14                   while turn==2 //do nothing
15                   end
16                   c1=0;
17               end
18           end
19           //critical section
20           count0=count0+a;
21           i=i+a;
22           // yield
23           c1=1;
24           turn=2;
25           //remainder section
26           if (count0>limit) | (i>limit) then
27               printf("Exceeds the limit of CS\n")
28               printf("END\n");
29               i = 100;
30           else
31               if(a>0)
32                printf("Process P1 Enters the
                    Critical section");
33                printf("\nTotal Time of P1 in
```

```
                    Critical Section :%d\n",count0);
34                  end
35                  printf("\nIt is the turn process P2\n
                      ");
36              end
37      end
38
39      //PROCESS 2 ENTERS
40      if x==2 then                        // Option 2
41              c2=0;
42              while c1==0
43                  if turn==1
44                      c2=1;
45                      while turn==1 //do nothing
46                      end
47                      c2=0;
48                  end
49              end
50              //critical section
51              count1=count1+b;
52              i=i+b;
53              // yield
54              c2=1;
55              turn=1;
56              //remainder section
57              if (count1>limit) | (i>limit) then
58                  printf("Exceeds the limit of CS\n")
59                  printf("END\n");
60                  i = 100;
61              else
62                  if(b>0)
63                   printf("Process P2 Enters the
                        Critical section");
64                   printf("\nTotal Time of P2 in
                        Critical Section :%d\n",count1);
65                  end
66                  printf("\nIt is the turn process P1\n
                      ");
```

```
67              end
68      end
69
70      //BOTH PROCESS ENTER AT SAME TIME  Option 3
71      if x==3 then
72          printf("\nBoth process cant enter at same
               time in Critical Section\n");
73          if i>limit then
74                  printf("END\n");
75                  i = 100;
76          end
77      end
78
79      //END for OTHER CONDITIONS  Option 4
80      if x==4 then
81          printf("\nEND\n");
82         i = 100;
83              end
84  end
85  endfunction
```

Dekker Algorithm

**Scilab code AP 17**

```
1  //  Deadlock - Bankers Algorithm
2
3  function [] = Deadlock(n,m)
4
5  // P0 P1 P2 P3 and P4 are the process names.
6  A=[0 1 0;2 0 0;3 0 2;2 1 2;0 0 2]; // Giving the
       process allocation values
7  M=[7 5 3;3 2 2;9 0 2;2 2 2;4 3 3]; // Giving the
       maximum values
8  L=[3 3 2]; // This gives the available values
9  ind=0;
10 ans1=list();
11 z=1;
12 f=list();
13
```

```
14 for k=1:5 // Iterating the values for all the 5
      processes
15     f(k)=0;
16 end
17
18 for i=1:5 //Iterating the values for all the
      processes
19     for j=1:3 //Iterating the value for all the
         processes
20         need(i,j)= M(i,j) - A(i,j); // Need is
            calculated by subtacting the maximum and
            availabe resources
21
22     end;
23
24 end
25 y=0;
26 for k=1:5 // Iterating for all the 5 processes
27     for i=1:5
28         if(f(i)==0) then
29             flag = 0; //Flag value is set zero
30         for j=1:3 // Iterating for all the resources
31             if (need(i,j) > L(j)) then // If the
                need value is more than the Available
                 resources, the request cannot be
                granted
32                 flag=1; // Then the flag is set to 1
33                 break; // The loop breaks here
34             end
35         end
36         if (flag==0) then // If the condition is
            satisfied the next process is checked
            similarly
37             ans1(z)=i;
38             z=z+1;
39
40         for y=1:3
41             L(y)= L(y)+A(i,y); //If the condition is
```

```
                satisfied the available valueis
               updated by adding available value and
                the allocated resources of the
               particular process
42              end
43              f(i)=1;
44          end
45      end
46      end
47  end
48
49  //For loop for displaying SAFE Sequence which
       satisfies the safety
50  for i=1:5
51      ans1(i)=ans1(i)-1;
52  end
53  for i=1:5
54
55          mprintf('    <P%d>,',ans1(i));
56
57  end;
58  endfunction
```

Deadlock Bankers Algorithm

**Scilab code AP 18** //Function for RoundRobin Algorithm

```
2
3  function [tat,wait_time]=roundrobin(q,n,at,bt)
4
5  remain = n//Storing no of process in a variable
       called n
6
7  wait_time=0;
8  tat=0;
9
10 quantum_time=q;
11 //disp("Process                Turnaround time
              Waiting time");
```

```
12
13 time=0;//completion time is initially set to zero
14
15 for i=1:4
16     rt(i)=bt(i);
17 end;
18
19 //running the processes for specified quantum
20 while remain~=0
21       for i=1:4
22
23         if rt(i)<=quantum_time & rt(i)>0 then  //
              executes if burst time is greater than 0
              and lesser than quantum time
24             time=time+rt(i);// update completion
                 time
25             rt(i)=0;
26             flag=1;
27         elseif rt(i)>0 then
28                 rt(i)=rt(i)-quantum_time;//update
                    burst time
29                 time=time+quantum_time;
30         end;
31         if rt(i)==0 & flag==1 then //executes if
              burst time is equal to 0 and flag=1
32                 remain = remain-1;
33                 mprintf('\n P%i\t\t\t %i\t\t\t %i',i
                    ,time-at(i),time-at(i)-bt(i));
34                 tat=tat+time-at(i);//Turnaround time
                     = completion time-arrival time
35                 wait_time = wait_time+time-at(i)-bt(
                    i);//Waiting time = turnaround-
                    burst time
36                 flag=0;
37          end;
38          if i==n-1
39              i=1;
40          elseif at(i)<=time then //executes when
```

```
                arrival time is lesser than/equal to
                completion time
41            i=1;
42            else
43            i=1;
44           end;
45        end;
46  end;
47
48  // display funcnction call
49  d   = displayfunc(tat,wait_time);  //Average
       Displaying turn around time and Average waiting
       time
50
51  endfunction
```

Round Robin Scheduling New

**Scilab code AP 9**

```
 1  function [atat,awt] = displayfunc(tat,wait_time)
2      awt=wait_time*1.0/4; //Total wait_time/no of
          processes gives average waiting time,
          similarly avg turnaround time is calculated
3      atat=tat*1.0/4;
4
5      mprintf("\n")
6
7      disp("Average Waiting Time using RR= "); //
          Displaying Average waiting time
8      disp(awt);
9
10     disp("Average Turnaround Time using RR= "); //
          Displaying Average Turnaround time
11     disp(atat);
12  endfunction
```

Display Function of Round Robin

**Scilab code AP 10** // SJF Scheduling function

```
2
3  function [tat,wait_time]=shortestjobfirst(num,btime,
       wtime,tatime)
4       total=0;          //total waiting time
5       total2=0;
6       n=num;
7       ptime=btime;
8       process=[1 2 3 4];   //process id
9           fd = %io(2);
10
11 for i=1:1:n-1    //sorting the processes in terms of
       process times
12     for j=i+1:1:n
13         if(ptime(i)>ptime(j))
14             temp=ptime(i);
15             ptime(i) = ptime(j);
16             ptime(j) = temp;
17             temp = process(i);
18             process(i) = process(j);
19             process(j) = temp;
20         end
21    end
22
23 end
24
25 wtime(1) = 0;
26  for i=2:1:n
27      wtime(i) = wtime(i-1)+ptime(i-1);    //wait time
           of a process is sum of wait time of process
           before it and process time of process before
           it
28      total = total + wtime(i);            //finding
           total waiting time
29 end
30
31  tatime(1) = 0;
32 for i=1:1:n
```

```
33      tatime(i)=ptime(i)+wtime(i);     //turn around
           time=burst time +wait time
34      total2=total2+tatime(i);                  //total
           turn around time
35  end
36
37  avg1 = total2/n;                              //finding
       average time
38
39  for i=1:1:n
40      mfprintf(fd,'   P%d is %d',process(i),tatime(i))
           ;
41  end
42
43  mfprintf(fd,'\n  Average Turn-Around Time in SJF
           %.2f',avg1);
44
45  endfunction
```

SJF algorithm for Turn Around Time and Average Turn Around Time calculation

**Scilab code AP 111** // Round Robin Scheduling function

```
2
3   function [tat,wait_time]=roundrobin(num,btime,wtime,
       tatime)
4   b=0;
5   t=0;
6   n=num
7   q=5;                    //quantum time
8   wtime=zeros(1,n); //waiting time
9   fd = %io(2);
10  rtime=btime             // burst time
11
12  //For loop : running the processes for specified
       quantum
13
14  for i=1:1:n             //running the processes for 1
```

```
    quantum
15      if(rtime(i)>=q)
16          for j=1:1:n
17              if(j==i)
18                  rtime(i)=rtime(i)-q;     //setting
                       the remaining time if it is the
                       process scheduled
19              else if(rtime(j)>0)
20                      wtime(j)=wtime(j)+q;     //
                           incrementing wait time if it
                           is not the process scheduled
21                  end
22              end
23          end
24      else if(rtime(i)>0)
25              for j=1:1:n
26                if(j==i)
27                  rtime(i)=0;                  //as the
                        remaining time is less than
                       quantum it will run the process
                       and end it
28                else if(rtime(j)>0)
29                      wtime(j)=wtime(j)+rtime(i);
                           //incrementing wait time if
                           it is not the process
                           scheduled
30                    end
31                end
32              end
33          end
34      end
35  end
36  for i=1:1:n
37      if(rtime(i)>0)       //if remaining time is left
           set flag
38          flag=1;
39      end
40  end
```

```
41 while(flag==1)           //if flag is set run the
      above process again
42     flag=0;
43     for i=1:1:n
44         if(rtime(i)>=q)
45             for j=1:1:n
46                 if(j==i)
47                     rtime(i)=rtime(i)-q;
48                 else if(rtime(j)>0)
49                         wtime(j)=wtime(j)+q;
50                     end
51                 end
52             end
53         else if(rtime(i)>0)
54                 for j=1:1:n
55                     if(j==i)
56                         rtime(i)=0;
57                     else if(rtime(j)>0)
58                             wtime(j)=wtime(j)+rtime(
                                i);
59                         end
60                     end
61                 end
62             end
63         end
64     end
65     for i=1:1:n
66         if(rtime(i)>0)
67             flag=1;
68         end
69     end
70 end
71
72 //For loop : calculating turn around time for each
      process
73 for i=1:1:n
74     tatime(i)=wtime(i)+btime(i);     //By adding
         waiting time and burst time
```

```
75 end
76 for i=1:1:n
77     b=b+wtime(i);
78     t=t+tatime(i);
79 end
80
81 for i=1:1:n
82     mfprintf(fd,'   P%d is %d',i,tatime(i));
83 end
84
85 //displaying the Average Turn-Around Time in RR
86
87 mfprintf(fd,'\n  Average Turn-Around Time in RR
          %.2f',t/n);
88
89 endfunction
```

Round Robin Scheduling for Turn Around Time and Average Turn Around Time calculation

**Scilab code AP 12** `function [tat,wait_time]= firstcomefirstserve(num,btime,wtime,tatime) // Function defintion of first come first serve`

```
2
3 t1=0;                 // intializing time t1=0 for
     total waiting time calculation
4 t2=0;                // intializing time t2=0 for
     total turn round time calculation
5
6 btime = bt;           // assigning burst time
7 wtime = wt;           // assigning waiting time
8 tatime = tat          // assigning turn around time
9 n=num;                // assigning number of process n
     =4 here
10     fd = %io(2);
11
12  //For loop for calculating total turn around time
      of each Process
```

```
13   for i=2:1:n
14    wtime(i)=btime(i-1)+wtime(i-1);  //waiting time
        will be sum of burst time of previous process
        and waiting time of previous process
15    t1=t1+wtime(i);                  //calculating
        total time
16 end
17
18 for i=1:1:n
19     tatime(i)=btime(i)+wtime(i);    //turn around
         time=burst time +wait time
20     t2=t2+tatime(i);                //total turn
         around time
21 end
22
23     for i=1:1:n
24         mfprintf(fd,'   P%d is %d',i,tatime(i));
25     end
26
27
28 mfprintf(fd,'\n  Average Turn-Around Time in FCFS
       %.2f',t2/n);
29
30 endfunction
```

FCFS Turn Around and Average Turn Around Calculation

**Scilab code AP 13** // SJF Scheduling

```
2
3 function [tat,wait_time]=shortestjobfirst(num,btime,
    wtime,tatime)
4     total=0;         //total waiting time
5     n=num;
6     ptime=btime;
7     process=[1 2 3 4];  //process id
8         fd = %io(2);
9
```

```
10 for i=1:1:n-1   //sorting the processes in terms of
      process times
11    for j=i+1:1:n
12        if(ptime(i)>ptime(j))
13            temp=ptime(i);    // assigning Temporary
                 variable for sorting
14            ptime(i) = ptime(j);
15            ptime(j) = temp;
16            temp = process(i);
17            process(i) = process(j);
18            process(j) = temp;
19        end
20   end
21
22 end
23
24  wtime(1) = 0;
25  for i=2:1:n
26     wtime(i) = wtime(i-1)+ptime(i-1);   //wait time
          of a process is sum of wait time of process
          before it and process time of process before
          it
27     total = total + wtime(i);           //finding
          total waiting time
28 end
29
30 avg = total/n;                         //finding
      average time
31
32 for i=1:1:n
33     mfprintf(fd,'   P%d is %d',process(i),wtime(i));
34 end
35
36 mfprintf(fd,'\n   Average Waiting Time in SJF is
         %.2f',avg);
37
38 endfunction
```

**Scilab code AP 14** // Round Robin Scheduling

```
2  function [tat,wait_time]=roundrobin(num,btime,wtime,
       tatime)
3  b=0;
4  t=0;
5  n=num
6  q=5;                    //quantum time
7  wtime=zeros(1,n); //waiting time
8  fd = %io(2);
9  rtime=btime
10
11 //running the processes for specified quantum
12 for i=1:1:n             //running the processes for
       quantum =5
13     if(rtime(i)>=q)
14         for j=1:1:n
15             if(j==i)
16                 rtime(i)=rtime(i)-q;     //setting
                       the remaining time if it is the
                       process scheduled
17             else if(rtime(j)>0)
18                     wtime(j)=wtime(j)+q;     //
                           incrementing wait time if it
                           is not the process scheduled
19                 end
20             end
21         end
22     else if(rtime(i)>0)
23             for j=1:1:n
24               if(j==i)
25                 rtime(i)=0;                  //as the
                       remaining time is less than
                       quantum it will run the process
                       and end it
26               else if(rtime(j)>0)
```

```
27                      wtime(j)=wtime(j)+rtime(i);
                           //incrementing wait time if
                           it is not the process
                           scheduled
28                  end
29              end
30          end
31      end
32  end
33  end
34  for i=1:1:n
35      if(rtime(i)>0)       //if remaining time is left
           set flag
36        flag=1;
37      end
38  end
39
40  //Total waiting time , processes  average waiting
       time calculation
41  while(flag==1)           //if flag is set run the
       above process again
42      flag=0;
43      for i=1:1:n
44          if(rtime(i)>=q)
45              for j=1:1:n
46                  if(j==i)
47                      rtime(i)=rtime(i)-q;
48                  else if(rtime(j)>0)
49                          wtime(j)=wtime(j)+q;
50                      end
51                  end
52              end
53          else if(rtime(i)>0)
54                  for j=1:1:n
55                      if(j==i)
56                          rtime(i)=0;
57                      else if(rtime(j)>0)
58                              wtime(j)=wtime(j)+rtime(
```

```
                                        i);  // Updation of
                                        waiting time for each
                                         process
59                              end
60                          end
61                      end
62                  end
63              end
64          end
65          for i=1:1:n
66              if(rtime(i)>0)
67                  flag=1;
68              end
69          end
70  end
71
72  //displaying the waiting time in RR
73
74  for i=1:1:n
75      mfprintf(fd,'   P%d is %d',i,wtime(i));
76  end
77
78  // Calculating Average Waiting Time
79  for i=1:1:n
80      b=b+wtime(i);
81          t=t+tatime(i);
82
83  end
84
85  //displaying the Average waiting time in RR
86
87  mfprintf(fd,'\n   Average Waiting Time in Round
       Robin is      %.2f',b/n);
88
89  endfunction
```

Round Robin Scheduling for Waiting and Average Waiting Time calculation

**Scilab code AP 15** function [tat,wait_time]= firstcomefirstserve(num,btime,wtime,tatime) // Function defintion of first come first serve

```
2
3  t1=0;                  // intializing time t1=0 for
       total waiting time calculation
4  t2=0;                 // intializing time t2=0 for
       total turn round time calculation
5
6  btime = bt;           // assigning burst time
7  wtime = wt;           // assigning waiting time
8  tatime = tat          // assigning turn around time
9  n=num;                // assigning number of process n
       =4 here
10     fd = %io(2);
11
12   //For loop for calculating total waiting time of
       each Process
13     for i=2:1:n
14      wtime(i)=btime(i-1)+wtime(i-1);  //waiting time
            will be sum of burst time of previous
           process and waiting time of previous process
15      t1=t1+wtime(i);                    //calculating
           total waiting time
16     end
17
18
19     //displaying the waiting time of each Process
20     for i=1:1:n
21         mfprintf(fd,'   P%d is %d',i,wtime(i));
22    end
23
24 mfprintf(fd,'\n   Average Waiting Time in FCFS is
         %.2f',t1/n);
25
26 endfunction
```

FCFS Waiting and Average Waiting Calculation

**Scilab code AP 16** //WINDOWS 10 64-BIT OS , Scilab and toolbox versions 6.1.0.

```
2
3 // loading the necessary functions
4 function [tat,wait_time]=shorestjobfirst(pid,num,pt,
    wt,tat)  // Function defintion of first come
    first serve
5
6 process=pid;  //process id
7 n=num;      // number of processes
8 ptime = pt;  //process time or burst time
9 tatime =tat;  //turn around time
10 wtime = wt;   //waiting time
11 fd = %io(2);
12
13 //Determining the number of processes and blocks
14 size_process = size(process);
15 size_process = size_process(2);
16 size_ptime = size(ptime);
17 size_ptime = size_ptime(2);
18
19 //marks the position of process with minimum burst
    time in the specified range. This may be used to
    rearrange the order of the processes to achieve
    proper SJF scheduling...
20 for i=1:1:n-1   //For loop for sorting the processes
     in terms of process times
21    for j=i+1:1:n
22        if(ptime(i)>ptime(j))
23            temp=ptime(i);           //temporary
                variable used to enable efficient
                swapping of values ..
24            ptime(i) = ptime(j);
25            ptime(j) = temp;
26            temp = process(i);
27            process(i) = process(j);
28            process(j) = temp;
29        end
```

```
30    end
31
32  end
33
34   wtime(1) = 0;
35   //waiting time calculation
36   for i=2:1:n
37       wtime(i) = wtime(i-1)+ptime(i-1);    //wait time
            of a process is sum of wait time of process
            before it and process time of process before
            it
38       total = total + wtime(i);            //finding
            total waiting time
39  end
40
41  //total turnaround time calculation
42  for i=1:1:n
43       tatime(i)=ptime(i)+wtime(i);     //turn around
            time=burst time +wait time
44       total2=total2+tatime(i);                //total
            turn around time
45  end
46
47  avg = total/n;                               //finding
      average time, average waiting time calculated by
      dividing total waiting time by number of proceses
48  avg1 = total2/n;                             //average
      turn around time calculated by dividing total
      turn around time by number of processes
49
50  display(process,size_process,wtime,tatime,avg,avg1);
                //displaying the process and block
      allocation by first fit array
51  endfunction
```

SJF New

**Scilab code AP 17** //WINDOWS 10 64-BIT OS , Scilab and toolbox versions 6.1.0.

```
2 //Display Function:It prints all required details such as Process no.
3 //Waiting time, Turn-Around time, Average Waiting time and Average Turn-Around time
4
5 function display(process,size_process,wtime,tatime,avg,avg1)
6             //display of final values
7
8 for i=1:1:n
9     mfprintf(fd,'   P%d',process(i));   // Displaying sorted Process based on its Shortest Job
10 end
11
12 disp('Waiting time of each Process using SFJ'); // displaying the Waiting time
13 for i=1:1:n
14     mfprintf(fd,'   P%d is %d',process(i),wtime(i));
15 end
16
17 disp('Turn-Around time of each Process using SFJ'); //displaying the Turn-Around time
18 for i=1:1:n
19     mfprintf(fd,'   P%d is %d',process(i),tatime(i));
20 end
21
22 mfprintf(fd,'\n   Average Waiting Time using SJF is %.2f',avg);   //displaying the Average Waiting time
23 mfprintf(fd,'\n   Average Turn-Around Time using SFJ is %.2f',avg1);  //displaying the Average Turn-Around time
24
25 endfunction
```

**Scilab code AP 18**

```
function [tat,wait_time]=firstcomefirstserve(num,btime,wtime,tatime)  //Function defintion of first come first serve

t1=0;                 // intializing time t1=0 for total waiting time calculation
t2=0;                 // intializing time t2=0 for total turn round time calculation

btime = bt;           // assigning burst time
wtime = wt;           // assigning waiting time
tatime = tat          // assigning turn around time
n=num;                // assigning number of process n=4 here
    fd = %io(2);

 //For loop for calculating total waiting time of each Process
    for i=2:1:n
     wtime(i)=btime(i-1)+wtime(i-1);  //waiting time will be sum of burst time of previous process and waiting time of previous process
     t1=t1+wtime(i);                  //calculating total waiting time
    end

//For loop for calculating total turn around time of each Process
    for i=1:1:n
     tatime(i)=btime(i)+wtime(i);     //turn around time=burst time +wait time
     t2=t2+tatime(i);                 //total turn around time
    end

```

```
24
25      //displaying the waiting time of each Process
26      for i=1:1:n
27          mfprintf(fd,'   P%d is %d',i,wtime(i));
28     end
29
30      disp('Turn-Around Time of each Process');
          //displaying the final Turn-Around time of
          each Process
31      for i=1:1:n
32          mfprintf(fd,'   P%d is %d',i,tatime(i));
33      end
34
35      mfprintf(fd,'\n   Average Waiting Time is  %.2f'
          ,t1/n);          //displaying the Average
          waiting time
36      mfprintf(fd,'\n   Average Turn-Around Time  is %
          .2f',t2/n);    //displaying the Average Turn
          Around time
37
38  endfunction
```

First Come First Serve CPU Scheduling