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1.

```c
#include<stdio.h>

void main()
{
int bt[20], wt[20], tat[20], i, n;
float cwt, ctat;

printf("\nEnter the number of processes -- ");
scanf("%d", &n);
for(i=0;i<n;i++)
{
printf("\nEnter Burst Time for Process %d -- ", i);
scanf("%d", &bt[i]);
}
wt[0] = cwt = 0;
tat[0] = ctat = bt[0];
for(i=1;i<n;i++)
{
wt[i] = wt[i-1] +bt[i-1];
tat[i] = tat[i-1] +bt[i];
cwt = cwt + wt[i];
ctat = ctat + tat[i];
}
printf("\t PROCESS \tBURST TIME \t WAITING TIME\t TURNAROUND TIME\n");

for(i=0;i<n;i++)
printf("\n\t P%d \t\t %d \t\t %d \t\t %d", i, bt[i], wt[i], tat[i]);
printf("\nAverage Waiting Time -- %f", cwt/n);
printf("\nAverage Turnaround Time -- %f", ctat/n);

}
```

```
akshat@VivoBook:~/Documents/os/2$ gcc 1.c  -o  FCFS
akshat@VivoBook:~/Documents/os/2$ ./FCFS

Enter the number of processes -- 5

Enter Burst Time for Process 0 -- 2

Enter Burst Time for Process 1 -- 3

Enter Burst Time for Process 2 -- 1

Enter Burst Time for Process 3 -- 4

Enter Burst Time for Process 4 -- 2
         PROCESS        BURST TIME       WAITING TIME    TURNAROUND TIME

         P0              2               0               2
         P1              3               2               5
         P2              1               5               6
         P3              4               6               10
         P4              2               10              12
Average Waiting Time -- 4.600000
Average Turnaround Time -- 7.000000akshat@VivoBook:~/Documents/os/2$
```

2.

```cpp
#include <iostream>

using namespace std;

// To heapify a subtree rooted with node i which is
// an index in arr[]. n is size of heap
void heapify(int arr[], int n, int i)
{
	int largest = i; // Initialize largest as root
	int l = 2 * i + 1; // left = 2*i + 1
	int r = 2 * i + 2; // right = 2*i + 2

	// If left child is larger than root
	if (l < n && arr[l] > arr[largest])
		largest = l;

	// If right child is larger than largest so far
	if (r < n && arr[r] > arr[largest])
		largest = r;

	// If largest is not root
	if (largest != i) {
		swap(arr[i], arr[largest]);

		// Recursively heapify the affected sub-tree
		heapify(arr, n, largest);
	}
}

// main function to do heap sort
void heapSort(int arr[], int n)
{
	// Build heap (rearrange array)
	for (int i = n / 2 - 1; i >= 0; i--)
		heapify(arr, n, i);

	// One by one extract an element from heap
	for (int i = n - 1; i > 0; i--) {
		// Move current root to end
		swap(arr[0], arr[i]);

		// call max heapify on the reduced heap
		heapify(arr, i, 0);
	}
}

/* A utility function to print array of size n */
void printArray(int arr[], int n)
{
	for (int i = 0; i < n; ++i)
		cout << arr[i] << " ";
	cout << "\n";
}
```

```
// Driver code
int main()
{
        int arr[] = { 12, 11, 13, 5, 6, 7 };
        int n = sizeof(arr) / sizeof(arr[0]);

        heapSort(arr, n);

        cout << "Sorted array is \n";
        printArray(arr, n);
}
```

```
akshat@VivoBook:~/Documents/os/2/2/2$ ./a.out
Enter no of processes: 4

Enter burst time for process 0: 3

Enter burst time for process 1: 2

Enter burst time for process 2: 1

Enter burst time for process 3: 4


Enter arrival time for process 0: 0

Enter arrival time for process 1: 1

Enter arrival time for process 2: 2

Enter arrival time for process 3: 3

Processes  Burst Time  Arrival Time  Waiting Time  Turn-Around Time  Completion Time
 1              3              0              0                3                3
 2              2              1              2                4                5
 3              1              2              3                4                6
 4              4              3              3                7                10
Average waiting time = 2
Average turn around time = 4.5akshat@VivoBook:~/Documents/os/2/2/2$
```

3.

```c
#include <stdio.h>
int main()
{
    int p[20], bt[20], wt[20], tat[20], i, k, n, temp;
    float cwt, ctat;
    printf("\nEnter the number of processes -- ");
    scanf("%d", &n);
    for (i = 0; i < n; i++)
    {
        p[i] = i;
        printf("Enter Burst Time for Process %d -- ", i);
        scanf("%d", &bt[i]);
    }
    for (i = 0; i < n; i++)
        for (k = i + 1; k < n; k++)
            if (bt[i] > bt[k])
            {
                temp = bt[i];
                bt[i] = bt[k];
                bt[k] = temp;
                temp = p[i];
                p[i] = p[k];
                p[k] = temp;
            }
    wt[0] = cwt = 0;
    tat[0] = ctat = bt[0];
    for (i = 1; i < n; i++)
    {
        wt[i] = wt[i - 1] + bt[i - 1];
        tat[i] = tat[i - 1] + bt[i];
        cwt = cwt + wt[i];
        ctat = ctat + tat[i];
    }
    printf("\n\t PROCESS \tBURST TIME \t WAITING TIME\t TURNAROUND TIME\n");
    for (i = 0; i < n; i++)
        printf("\n\t P%d \t\t %d \t\t %d \t\t %d", p[i], bt[i], wt[i], tat[i]);
    printf("\nAverage Waiting Time -- %f", cwt / n);
    printf("\nAverage Turnaround Time -- %f", ctat / n);
    return 0;
}
```

```
akshat@VivoBook:~/Documents/os/2/2/2$ gcc SJF.c -o SJF
akshat@VivoBook:~/Documents/os/2/2/2$ ./SJF

Enter the number of processes -- 4
Enter Burst Time for Process 0 -- 3
Enter Burst Time for Process 1 -- 4
Enter Burst Time for Process 2 -- 2
Enter Burst Time for Process 3 -- 4

         PROCESS        BURST TIME       WAITING TIME    TURNAROUND TIME

         P2              2               0               2
         P0              3               2               5
         P1              4               5               9
         P3              4               9               13
Average Waiting Time -- 4.000000
Average Turnaround Time -- 7.250000akshat@VivoBook:~/Documents/os/2/2/2$
```

4.

```cpp
#include <iostream>
using namespace std;
int mat[10][6];
void swap(int *a, int *b){
    int temp = *a;
    *a = *b;
    *b = temp;
}

void arrangeArrival(int num, int mat[][6]){
    for (int i = 0; i < num; i++) {
        for (int j = 0; j < num - i - 1; j++)    {
            if (mat[j][1] > mat[j + 1][1])   {
                for (int k = 0; k < 5; k++)
                 swap(mat[j][k], mat[j + 1][k]);
            }
        }
    }
}
void completionTime(int num, int mat[][6]){
    int temp, val;
    mat[0][3] = mat[0][1] + mat[0][2];
    mat[0][5] = mat[0][3] - mat[0][1];
    mat[0][4] = mat[0][5] - mat[0][2];
    for (int i = 1; i < num; i++){
        temp = mat[i - 1][3];
        int low = mat[i][2];
        for (int j = i; j < num; j++)  {
            if (temp >= mat[j][1] && low >= mat[j][2])   {
                low = mat[j][2];
                val = j;
            }
        }
        mat[val][3] = temp + mat[val][2];
        mat[val][5] = mat[val][3] - mat[val][1];
        mat[val][4] = mat[val][5] - mat[val][2];
        for (int k = 0; k < 6; k++) swap(mat[val][k], mat[i][k]);
    }
}
int main(){
    int num, temp;
    cout << "Enter number of Process: ";
    cin >> num;
    cout << "...Enter the process ID...\n";
    for (int i = 0; i < num; i++)
    {
        cout << "...Process " << i + 1 << "...\n";
        cout << "Enter Process Id: ";
        cin >> mat[i][0];
        cout << "Enter Arrival Time: ";
        cin >> mat[i][1];
        cout << "Enter Burst Time: ";
        cin >> mat[i][2];
    }
```

```
    cout << "Before Arrange...\n";
    cout << "Process ID\tArrival Time\tBurst Time\n";
    for (int i = 0; i < num; i++)
    {
        cout << mat[i][0] << "\t\t" << mat[i][1] << "\t\t"
             << mat[i][2] << "\n";
    }

    arrangeArrival(num, mat);
    completionTime(num, mat);
    cout << "Final Result...\n";
    cout << "Process ID\tArrival Time\tBurst Time\tWaiting "
            "Time\tTurnaround Time\n";
    for (int i = 0; i < num; i++)
    {
        cout << mat[i][0] << "\t\t" << mat[i][1] << "\t\t"
             << mat[i][2] << "\t\t" << mat[i][4] << "\t\t"
             << mat[i][5] << "\n";
    }
}
```

```
Average Turnaround Time -- 7.250000akshat@VivoBook:~/Documents/os/2/2/2$ g++ SJFDT.cpp
akshat@VivoBook:~/Documents/os/2/2/2$ ./a.out
Enter number of Process: 4
...Enter the process ID...
...Process 1...
Enter Process Id: 1
Enter Arrival Time: 0
Enter Burst Time: 8
...Process 2...
Enter Process Id: 2
Enter Arrival Time: 1
Enter Burst Time: 4
...Process 3...
Enter Process Id: 3
Enter Arrival Time: 2
Enter Burst Time: 9
...Process 4...
Enter Process Id: 4
Enter Arrival Time: 3
Enter Burst Time: 5
Before Arrange...
Process ID      Arrival Time    Burst Time
1               0               8
2               1               4
3               2               9
4               3               5
Final Result...
Process ID      Arrival Time    Burst Time      Waiting Time    Turnaround Time
1               0               8               0               8
2               1               4               7               11
4               3               5               9               14
3               2               9               15              24
akshat@VivoBook:~/Documents/os/2/2/2$
```

5.

```
    for (int i = 1; i < n; i++)
    {
        wt[i] = wt[i - 1] + bt[i];
        tat[i] = tat[i - 1] + bt[i];
        cwt = cwt + wt[i];
        ctat = ctat + tat[i];
    }
    printf("\n\tProcess\tBurst Time \t Waiting Time \t Turnaround Time\n");
    for (int i = 0; i < n; i++)
    {
        printf("\n\tP%d\t\t %d \t\t %d \t\t %d", p[i], bt[i], wt[i], tat[i]);
        printf("\nAverage waiting time : %f", cwt /n);
        printf("\nAverage Turaround time : %f", ctat /n);
    }
}
```

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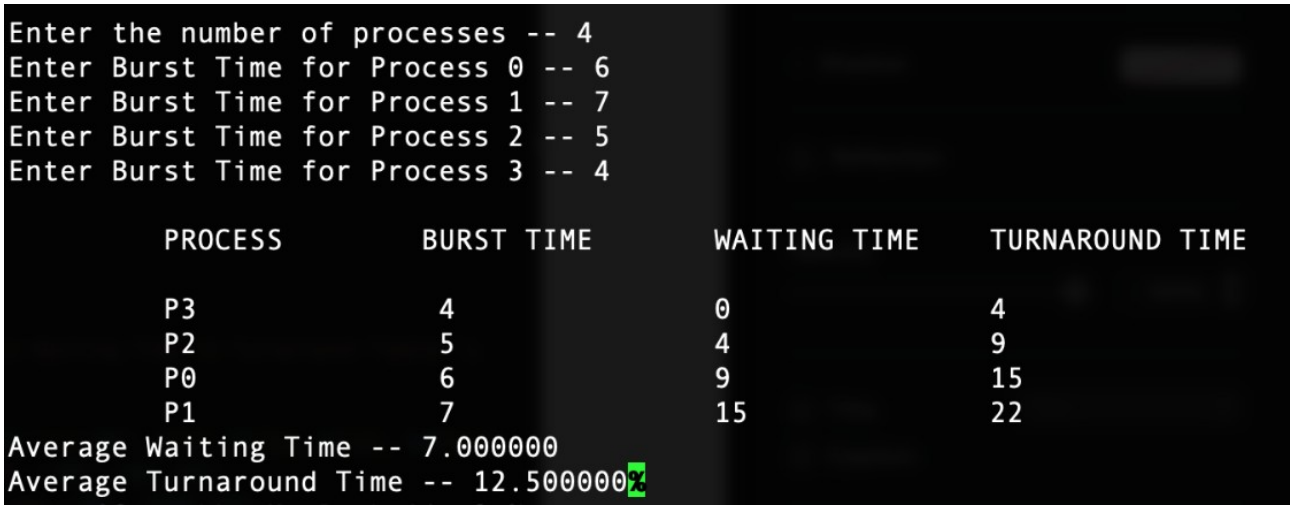
```
void heapSort(int arr[], int n, int t[])
{
    for (int i = n / 2; i >= 0; i++)
    {
        heapify(arr, n, i, t);
    }
    for (int i = n - 1; i > 0; i--)
    {
        swap(arr[0], arr[i]);
        swap(t[i], t[0]);
        heapify(arr, i, 0, t);
    }
}
void printArray(int arr[], int n)
{
    for (int i = 0; i < n; ++i)
    {
        cout << arr[i] << " ";
    }
    cout << "/n";
}

int main()
{
    int p[20], bt[20], wt[20], tat[20], i, k, n, temp;
    float cwt, ctat;
    printf("\n Enter the number of Process : ");
    scanf("%d", &n);
    for (i = 0; i < n; i++)
    {
        p[i] = i;
        printf("Enter Burst time for processe %d : ", i);
        scanf("%d", &bt[i]);
    }
    heapSort(bt, n, p);
    wt[0] = cwt = 0;
    tat[0] = ctat = bt[0];
```


Enter the number of processes -- 4
Enter Burst Time for Process 0 -- 6
Enter Burst Time for Process 1 -- 7
Enter Burst Time for Process 2 -- 5
Enter Burst Time for Process 3 -- 4
PROCESS BURST TIME WAITING TIME TURNAROUND TIME
P3 4 0 4
P2 5 4 9
P0 6 9 15
P1 7 15 22
Average Waiting Time -- 7.000000
Average Turnaround Time -- 12.500000