# LIST OF EXPERIMENTS

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2. string and numerical handling functions.

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    b) Write a shell script to extract the first and last character from a string.

    b) Write a shell script to find whether the given number is palindrome or not.

3. Loop and Selection constructs

    a) Write a shell script to find the factorial of a given number using for loop.

    b) Write a shell script to find the sum of n numbers using while loop.

    c) Write a shell script to implement menu driven program to perform all arithmetic operation using case statement.

    d) Write a shell script to print following pattern.

```
*
* *
* * *
* * * *
```

4. File Handling Functions:

    a) Converting File names from Uppercase to Lowercase

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7. Implementation of process scheduling mechanism – FCFS, SJF, Priority Queue.

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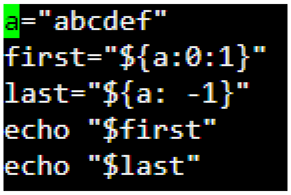
13. Implement some memory management Scheme

**EXP. No. 2.a Write a shell script to compare two string.**

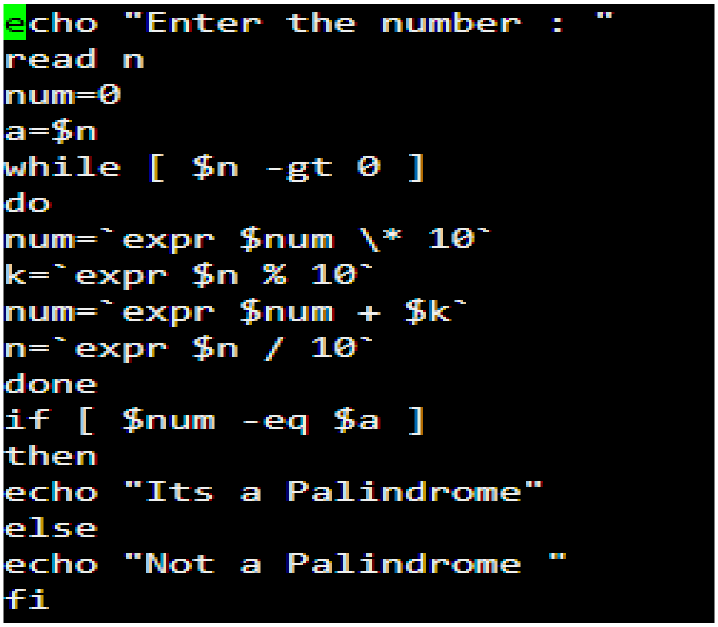
```
echo “Enter two string”
read a
read b
if [ -z $a ]
then
echo “ First String is empty: Null String”
fi
if [ -z $b ]
then
echo “ Second String is empty: Null String”
fi
if [ $a = $b ]
then
echo “Strings are equal: strings Matched”
else
echo “Strings are not equal: Strings not match”
fi
```

**EXP. No. 2.b Write a shell script to extract the first and last character from a string.**



```
a="abcdef"
first="${a:0:1}"
last="${a: -1}"
echo "$first"
echo "$last"
```

**EXP. No. 2.c Write a shell script to check whether the number is palindrome or not.**



```
echo "Enter the number : "
read n
num=0
a=$n
while [ $n -gt 0 ]
do
num=`expr $num \* 10`
k=`expr $n % 10`
num=`expr $num + $k`
n=`expr $n / 10`
done
if [ $num -eq $a ]
then
echo "Its a Palindrome"
else
echo "Not a Palindrome "
fi
```

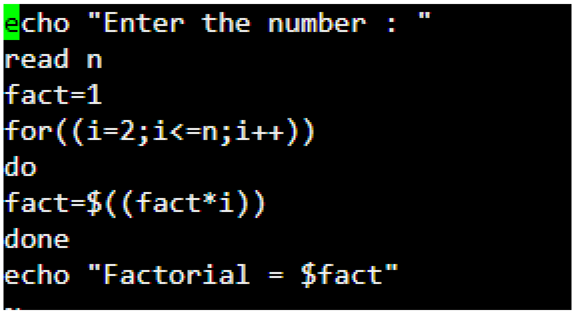
**EXP. No 3.a write a shell script to find the factorial of a given number.**

1. Get a number

2. Use for loop or while loop to compute the factorial by using the below formula

3. fact(n) = n * n-1 * n-2 * .. 1

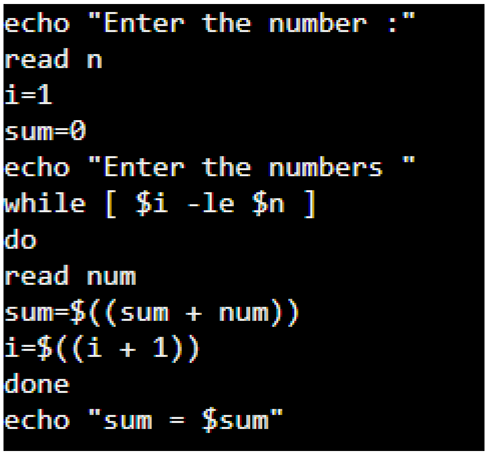
4. Display the result.



```
echo "Enter the number : "
read n
fact=1
for((i=2;i<=n;i++))
do
fact=$((fact*i))
done
echo "Factorial = $fact"
```

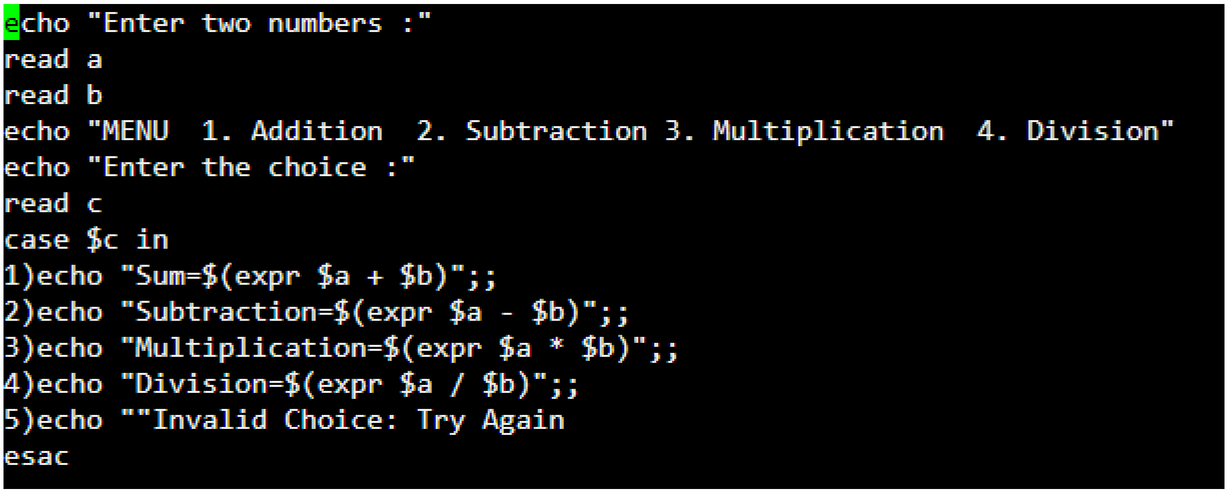
EXP. No 3.b Write a shell script to find the sum of n numbers using while loop.

1. Get N (Total Numbers).
2. Get N numbers using loop.
3. Calculate the sum.
4. Print the result.



```
echo "Enter the number :"
read n
i=1
sum=0
echo "Enter the numbers "
while [ $i -le $n ]
do
read num
sum=$((sum + num))
i=$((i + 1))
done
echo "sum = $sum"
```

EXP. No 3.c Write a shell script to implement menu driven program to perform all arithmetic operation using case statement.



```
echo "Enter two numbers :"
read a
read b
echo "MENU  1. Addition  2. Subtraction 3. Multiplication  4. Division"
echo "Enter the choice :"
read c
case $c in
1)echo "Sum=$(expr $a + $b)";;
2)echo "Subtraction=$(expr $a - $b)";;
3)echo "Multiplication=$(expr $a * $b)";;
4)echo "Division=$(expr $a / $b)";;
5)echo ""Invalid Choice: Try Again
esac
```

### EXP. No 3.d Write a shell script to print following pattern.

```
*
* *
* * *
* * * *
```

```
echo “ enter number of rows”
read n
i=1
while [  $i –le $n ]
do
j=1
while [ $j –le $i ]
do
echo –n “*”
j=$((j + 1))
done
echo
i=$((i + 1))
done
```

### EXP. No. 4.a Converting File names from Uppercase to Lowercase

```
var_name="THIS IS a TEST"
echo "$VAR_NAME" | tr '[:upper:]' '[:lower:]'
name="sathyabama"
echo "$name" | tr '[:lower:]' '[:upper:]'
```

### EXP. No. 4.b Write a shell script to count the number of characters, words and lines in the file.

**Create a file :**

```
cat > filename
My university name is Sathyabama
My  Department is Computer Science
This is Chennai
```

**Program:**

```
echo "enter file name"
read file
c=`cat $file | wc -c`
w=`cat $file | wc -w`
l=`grep -c "." $file`
echo "Number of characters is $c"
echo "Number of words is $w"
echo "Number of Lines is $l"
```

**EXP. No. 4.c Write a shell script to read and check the file exists or not, if not create the file.**

```
echo “enter name of file”
read filename
if [ -f $filename ]
then
echo “File $filename Exits!”
else
touch $filename
fi
```

EXP. No. 5 Write a shell script to Manipulate Date/Time/Calendar.

```
echo "Date in various forms"
echo $(date)
echo "Today is $(date +'%m/%d/%y')"
echo "Today is $(date +'%Y-%m-%d')"
echo "Calender is various form"
echo $(cal 9 2024)
echo $(cal 2024)
echo $(cal -m May)
echo "Time in various formats"
echo $(date +"%T")
echo $(date +"%r")
echo $(date +"%I:%S:%M")
```

EXP. No. 6 Write a shell script Showing various system information

```
echo "SYSTEM INFORMATION"
echo “Hello ,$LOGNAME”
echo “Current Date is = $(date)”
echo “User is ‘who I am’”
echo “Current Directory = $(pwd)”
echo "Network Name and Node Name = $(uname -n)"
echo "Kernal Name =$(uname -s)"
echo "Kernal Version=$(uname -v)"
echo "Kernal Release =$(uname -r)"
echo "Kernal OS =$(uname -o)"
echo “Proessor Type = $(uname -p)”
echo “Kernel Machine Information = $(uname –m)”
echo "All Information =$(uname -a)"
```

7 a FCFS

```
#include <stdio.h>

struct Process {
    int id, arrivalTime, burstTime, waitingTime, turnaroundTime;
};

void findWaitingTime(struct Process p[], int n) {
    p[0].waitingTime = 0;
    for (int i = 1; i < n; i++)
        p[i].waitingTime = p[i - 1].waitingTime + p[i - 1].burstTime;
}

void findTurnaroundTime(struct Process p[], int n) {
    for (int i = 0; i < n; i++)
        p[i].turnaroundTime = p[i].waitingTime + p[i].burstTime;
}

void findAverageTime(struct Process p[], int n) {
    findWaitingTime(p, n);
    findTurnaroundTime(p, n);

    printf("Process\tBurst Time\tWaiting Time\tTurnaround Time\n");
    for (int i = 0; i < n; i++) {
        printf("%d\t%d\t\t%d\t\t%d\n", p[i].id, p[i].burstTime, p[i].waitingTime, p[i].turnaroundTime);
    }
}

int main() {
    int n;
    printf("Enter number of processes: ");
    scanf("%d", &n);

    struct Process p[n];
    for (int i = 0; i < n; i++) {
        p[i].id = i + 1;
        printf("Enter burst time for process %d: ", i + 1);
        scanf("%d", &p[i].burstTime);
    }

    findAverageTime(p, n);
    return 0;
}
```

7b #include <stdio.h>

```
#include <stdio.h>

struct Process {
    int id, burstTime, waitingTime, turnaroundTime;
};
```

```
void findWaitingTime(struct Process p[], int n) {
    p[0].waitingTime = 0;
    for (int i = 1; i < n; i++)
        p[i].waitingTime = p[i - 1].waitingTime + p[i - 1].burstTime;
}

void findTurnaroundTime(struct Process p[], int n) {
    for (int i = 0; i < n; i++)
        p[i].turnaroundTime = p[i].waitingTime + p[i].burstTime;
}

void sortByBurstTime(struct Process p[], int n) {
    for (int i = 0; i < n - 1; i++) {
        for (int j = i + 1; j < n; j++) {
            if (p[i].burstTime > p[j].burstTime) {
                struct Process temp = p[i];
                p[i] = p[j];
                p[j] = temp;
            }
        }
    }
}

void findAverageTime(struct Process p[], int n) {
    sortByBurstTime(p, n);
    findWaitingTime(p, n);
    findTurnaroundTime(p, n);

    printf("Process\tBurst Time\tWaiting Time\tTurnaround Time\n");
    for (int i = 0; i < n; i++) {
        printf("%d\t%d\t\t%d\t\t%d\n", p[i].id, p[i].burstTime, p[i].waitingTime, p[i].turnaroundTime);
    }
}

int main() {
    int n;
    printf("Enter number of processes: ");
    scanf("%d", &n);

    struct Process p[n];
    for (int i = 0; i < n; i++) {
        p[i].id = i + 1;
        printf("Enter burst time for process %d: ", i + 1);
        scanf("%d", &p[i].burstTime);
    }

    findAverageTime(p, n);
    return 0;
}
```

7C priority queue

```
#include <stdio.h>
```

```
struct Process {
    int id, burstTime, priority, waitingTime, turnaroundTime;
};

void findWaitingTime(struct Process p[], int n) {
    p[0].waitingTime = 0;
    for (int i = 1; i < n; i++)
        p[i].waitingTime = p[i - 1].waitingTime + p[i - 1].burstTime;
}

void findTurnaroundTime(struct Process p[], int n) {
    for (int i = 0; i < n; i++)
        p[i].turnaroundTime = p[i].waitingTime + p[i].burstTime;
}

void sortByPriority(struct Process p[], int n) {
    for (int i = 0; i < n - 1; i++) {
        for (int j = i + 1; j < n; j++) {
            if (p[i].priority > p[j].priority) {
                struct Process temp = p[i];
                p[i] = p[j];
                p[j] = temp;
            }
        }
    }
}

void findAverageTime(struct Process p[], int n) {
    sortByPriority(p, n);
    findWaitingTime(p, n);
    findTurnaroundTime(p, n);

    printf("Process\tPriority\tBurst Time\tWaiting Time\tTurnaround Time\n");
    for (int i = 0; i < n; i++) {
        printf("%d\t%d\t\t%d\t\t%d\t\t%d\n", p[i].id, p[i].priority, p[i].burstTime, p[i].waitingTime,
p[i].turnaroundTime);
    }
}

int main() {
    int n;
    printf("Enter number of processes: ");
    scanf("%d", &n);

    struct Process p[n];
    for (int i = 0; i < n; i++) {
        p[i].id = i + 1;
        printf("Enter burst time and priority for process %d: ", i + 1);
        scanf("%d %d", &p[i].burstTime, &p[i].priority);
    }

    findAverageTime(p, n);
    return 0;
}
```

8 reader writers

```
#include <stdio.h>
#include <pthread.h>
#include <semaphore.h>

sem_t wrt;        // Semaphore to allow writer or reader access
pthread_mutex_t mutex;
int read_count = 0; // Track the number of readers

void *writer(void *arg) {
    sem_wait(&wrt);  // Writer enters critical section
    printf("Writer is writing\n");
    sem_post(&wrt);  // Writer exits critical section
    return NULL;
}

void *reader(void *arg) {
    pthread_mutex_lock(&mutex);
    read_count++;
    if (read_count == 1)
        sem_wait(&wrt);  // First reader locks the writer out
    pthread_mutex_unlock(&mutex);

    printf("Reader is reading\n");

    pthread_mutex_lock(&mutex);
    read_count--;
    if (read_count == 0)
        sem_post(&wrt);  // Last reader unlocks the writer
    pthread_mutex_unlock(&mutex);

    return NULL;
}

int main() {
    pthread_t r1, r2, w1;
    sem_init(&wrt, 0, 1);
    pthread_mutex_init(&mutex, NULL);

    pthread_create(&r1, NULL, reader, NULL);
    pthread_create(&r2, NULL, reader, NULL);
    pthread_create(&w1, NULL, writer, NULL);

    pthread_join(r1, NULL);
    pthread_join(r2, NULL);
    pthread_join(w1, NULL);

    sem_destroy(&wrt);
    pthread_mutex_destroy(&mutex);
    return 0;
}
```

9.Dinners Philosphers

```
#include <stdio.h>
#include <pthread.h>
#include <semaphore.h>

#define N 5  // Number of philosophers

sem_t chopstick[N];  // Semaphores for chopsticks

void *philosopher(void *num) {
    int id = *(int *)num;

    sem_wait(&chopstick[id]);              // Pick left chopstick
    sem_wait(&chopstick[(id + 1) % N]);    // Pick right chopstick

    printf("Philosopher %d is eating\n", id + 1);

    sem_post(&chopstick[id]);              // Put down left chopstick
    sem_post(&chopstick[(id + 1) % N]);    // Put down right chopstick

    printf("Philosopher %d is thinking\n", id + 1);
    return NULL;
}

int main() {
    pthread_t philosophers[N];
    int ids[N];

    for (int i = 0; i < N; i++)
        sem_init(&chopstick[i], 0, 1);  // Initialize chopstick semaphores

    for (int i = 0; i < N; i++) {
        ids[i] = i;
        pthread_create(&philosophers[i], NULL, philosopher, &ids[i]);
    }

    for (int i = 0; i < N; i++)
        pthread_join(philosophers[i], NULL);

    for (int i = 0; i < N; i++)
        sem_destroy(&chopstick[i]);  // Destroy semaphores

    return 0;
}
```

10. first fit, best fit , worst fit

```
#include <stdio.h>
```

```
#define MAX 5  // Maximum number of memory blocks

void firstFit(int blockSize[], int m, int processSize[], int n) {
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < m; j++) {
            if (blockSize[j] >= processSize[i]) {
                printf("First Fit: Process %d -> Block %d\n", i + 1, j + 1);
                blockSize[j] -= processSize[i];
                break;
            }
        }
    }
}

void bestFit(int blockSize[], int m, int processSize[], int n) {
    for (int i = 0; i < n; i++) {
        int bestIdx = -1;
        for (int j = 0; j < m; j++) {
            if (blockSize[j] >= processSize[i]) {
                if (bestIdx == -1 || blockSize[j] < blockSize[bestIdx])
                    bestIdx = j;
            }
        }
        if (bestIdx != -1) {
            printf("Best Fit: Process %d -> Block %d\n", i + 1, bestIdx + 1);
            blockSize[bestIdx] -= processSize[i];
        }
    }
}

void worstFit(int blockSize[], int m, int processSize[], int n) {
    for (int i = 0; i < n; i++) {
        int worstIdx = -1;
        for (int j = 0; j < m; j++) {
            if (blockSize[j] >= processSize[i]) {
                if (worstIdx == -1 || blockSize[j] > blockSize[worstIdx])
                    worstIdx = j;
            }
        }
        if (worstIdx != -1) {
            printf("Worst Fit: Process %d -> Block %d\n", i + 1, worstIdx + 1);
            blockSize[worstIdx] -= processSize[i];
        }
    }
}

int main() {
    int blockSize[MAX] = {100, 500, 200, 300, 600};
    int processSize[] = {212, 417, 112, 426};
    int m = sizeof(blockSize) / sizeof(blockSize[0]);
    int n = sizeof(processSize) / sizeof(processSize[0]);
    firstFit(blockSize, m, processSize, n);
    bestFit(blockSize, m, processSize, n);
    worstFit(blockSize, m, processSize, n);

    return 0;
}
```

## 11. Bankers Algorithm

```
#include <stdio.h>

#define MAX_PROCESSES 5
#define MAX_RESOURCES 3

int allocate[MAX_PROCESSES][MAX_RESOURCES], max[MAX_PROCESSES][MAX_RESOURCES],
need[MAX_PROCESSES][MAX_RESOURCES];
int available[MAX_RESOURCES];

void calculateNeed() {
    for (int i = 0; i < MAX_PROCESSES; i++)
        for (int j = 0; j < MAX_RESOURCES; j++)
            need[i][j] = max[i][j] - allocate[i][j];
}

int isSafe() {
    int finish[MAX_PROCESSES] = {0};
    int safeSeq[MAX_PROCESSES];
    int work[MAX_RESOURCES];

    for (int i = 0; i < MAX_RESOURCES; i++)
        work[i] = available[i];

    int count = 0;
    while (count < MAX_PROCESSES) {
        int found = 0;
        for (int p = 0; p < MAX_PROCESSES; p++) {
            if (!finish[p]) {
                int j;
                for (j = 0; j < MAX_RESOURCES; j++)
                    if (need[p][j] > work[j])
                        break;

                if (j == MAX_RESOURCES) {
                    for (int k = 0; k < MAX_RESOURCES; k++)
                        work[k] += allocate[p][k];
                    safeSeq[count++] = p;
                    finish[p] = 1;
                    found = 1;
                }
            }
        }
        if (!found) {
            printf("System is not in a safe state.\n");
            return 0;
        }
    }

    printf("System is in a safe state.\nSafe sequence is: ");
    for (int i = 0; i < MAX_PROCESSES; i++)
        printf("%d ", safeSeq[i]);
    printf("\n");
    return 1;
}

int main() {
    // Example data (can be modified)
    int n, m;

    printf("Enter number of processes: ");
    scanf("%d", &n);
    printf("Enter number of resources: ");
    scanf("%d", &m);

    printf("Enter allocation matrix:\n");
    for (int i = 0; i < n; i++)
        for (int j = 0; j < m; j++)
            scanf("%d", &allocate[i][j]);

    printf("Enter maximum matrix:\n");
    for (int i = 0; i < n; i++)
        for (int j = 0; j < m; j++)
            scanf("%d", &max[i][j]);

    printf("Enter available resources:\n");
    for (int j = 0; j < m; j++)
        scanf("%d", &available[j]);

    calculateNeed();
    isSafe();

    return 0;
}
```

12 producer consumer

```
#include <stdio.h>
#include <pthread.h>
#include <semaphore.h>

#define BUFFER_SIZE 5

int buffer[BUFFER_SIZE];
int count = 0;

sem_t empty, full;  // Semaphores
```

```
pthread_mutex_t mutex;

void *producer(void *arg) {
    for (int i = 0; i < 10; i++) {
        sem_wait(&empty);            // Wait for empty space
        pthread_mutex_lock(&mutex);  // Lock the buffer

        buffer[count++] = i;
        printf("Produced: %d\n", i);

        pthread_mutex_unlock(&mutex);  // Unlock the buffer
        sem_post(&full);               // Signal that the buffer has a new item
    }
    return NULL;
}

void *consumer(void *arg) {
    for (int i = 0; i < 10; i++) {
        sem_wait(&full);             // Wait for a full buffer
        pthread_mutex_lock(&mutex);  // Lock the buffer

        int item = buffer[--count];
        printf("Consumed: %d\n", item);

        pthread_mutex_unlock(&mutex);  // Unlock the buffer
        sem_post(&empty);              // Signal that the buffer has an empty space
    }
    return NULL;
}

int main() {
    pthread_t prod, cons;
    sem_init(&empty, 0, BUFFER_SIZE);  // Initialize empty semaphore
    sem_init(&full, 0, 0);             // Initialize full semaphore
    pthread_mutex_init(&mutex, NULL);  // Initialize mutex

    pthread_create(&prod, NULL, producer, NULL);
    pthread_create(&cons, NULL, consumer, NULL);

    pthread_join(prod, NULL);
    pthread_join(cons, NULL);

    sem_destroy(&empty);
    sem_destroy(&full);
    pthread_mutex_destroy(&mutex);

    return 0;
}
```

13. Best Memory allocation

```
#include <stdio.h>

#define MAX 5  // Maximum number of memory blocks
```

```
void firstFit(int blockSize[], int m, int processSize[], int n) {
    int allocation[n];

    for (int i = 0; i < n; i++) allocation[i] = -1; // Initialize all allocations to -1

    for (int i = 0; i < n; i++) {  // Process each process
        for (int j = 0; j < m; j++) {  // Find first fitting block
            if (blockSize[j] >= processSize[i]) {
                allocation[i] = j;
                blockSize[j] -= processSize[i];  // Reduce available block size
                break;
            }
        }
    }

    printf("Process No.\tProcess Size\tBlock No.\n");
    for (int i = 0; i < n; i++) {
        printf("%d\t\t%d\t\t", i + 1, processSize[i]);
        if (allocation[i] != -1)
            printf("%d\n", allocation[i] + 1);
        else
            printf("Not Allocated\n");
    }
}

int main() {
    int blockSize[MAX] = {100, 500, 200, 300, 600};
    int processSize[] = {212, 417, 112, 426};
    int m = sizeof(blockSize) / sizeof(blockSize[0]);
    int n = sizeof(processSize) / sizeof(processSize[0]);

    firstFit(blockSize, m, processSize, n);

    return 0;
}
```