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B.Tech. Computer Science and Engineering (AI)
Fourth Semester

22AIE212 Design and Analysis of Algorithms

Lab Sheet 3

Recursion

1. Print the sum of the first N natural numbers.

```
def sumN(N):
  if N == 1:
    return 1
  else:
    return N + sumN(N-1)

sumN(5)
```

```
15
```

2. Print the product of the first N natural numbers.

```
def prodN(N):
  if N == 1:
    return 1
  else:
    return N * prodN(N-1)

prodN(5)
```

```
120
```

3. Print the N^{th} Fibonacci number.

```
def fibonacciN(N):
  if N == 2:
    return 1
  elif N==1:
    return 0
  return fibonacciN(N-1) + fibonacciN(N-2)

fibonacciN(5)
```

```
3
```

4. Calculate x^y.

```
def power(x, y):
  if y==0:
    return 1
  else:
    return x * power(x, y-1)

power(2, 10)
```

```
1024
```

5. Print the first N natural numbers.

```
def Nnatural(N):
  if N==1:
    print(1, end=" ")
    return
  else:
    Nnatural(N-1)
    print(N, end=' ')

Nnatural(5)
```

```
1 2 3 4 5
```

6. Print the first N natural numbers in reverse order.

```
def Nnatural(N):
  if N==1:
    print(1, end=" ")
    return
  else:
    print(N, end=' ')
    Nnatural(N-1)

Nnatural(5)
```

```
5 4 3 2 1
```

7. Find the GCD(HCF) of two numbers.

```
def GCD(a, b):
  if b == 0:
    return a
  else:
    return GCD(b, a % b)

GCD(12, 16)
```

```
4
```

8. Print the elements of an array.

```
def ArrayDisp(A):
  if A == []:
    return
  print(A[0], end=" ")
  ArrayDisp(A[1:])

ArrayDisp([5, 4, 3, 2, 1, 0])
```

```
5 4 3 2 1 0
```

9. Print the elements of an array in reverse order.

```
def ArrayDisp(A):
  if A == []:
    return
  ArrayDisp(A[1:])
  print(A[0], end=" ")

ArrayDisp([5, 4, 3, 2, 1, 0])
```

```
0 1 2 3 4 5
```

10. Reverse a given number.

```
def revnum(N, r=0):
  if not N:
    return r
  else:
    return revnum(N//10, r*10 + N%10)


revnum(123001)
```

```
100321
```

11. Check if an array is sorted or not.

```
def checkSort(A):
  if len(A) < 2:
    return True
  if A[0]>A[1]:
    return False
  else:
    return checkSort(A[1:])

checkSort([5, 4, 3, 2, 1]), checkSort([1, 2, 3, 4, 4])
```

```
(False, True)
```