Agenda:

1. Iteration Problems.
2. Output Prediction
3. Basic debugging.

Problem:

1.
```
function constant():
    print("Hello"):
```

1. Times print is executed → 1
2. TC → O(1)
3. SC → O(1)

2.
```
function iterate(N):
    for i (1 → N):
        print(i):
```

1. Times print is executed → N
2. TC → O(N)
3. SC → O(1)

3.
```
function analyse(N):
    for (i: 1 → N):
        for (j: 1 → N):
            print(i, j):
    for (i: 1 → N):
        for (j: 1 → N):
            print(i+1, j+1);
```

1. Times print is executed → $2N^2$
2. TC → $O(N^2)$
3. SC → $O(1)$

4.
```
function scale(N):
    i = 1
    while (i < N):
        print(i)
        i = i * 2
```

1. Times print is executed → $\log_2 N$
2. TC → $O(\log N)$
3. SC → $O(1)$

$5N^2 + 3N + 500 \rightarrow 5N^2$

$O(N^2)$

$2^{10} = 1024$

$10^2 = 100$

Q3:

1st loop → N^2

2nd loop → N

3rd loop → 2^N

$N^2 + N + 2^N$

2^N or $N!$

32 120

$10! = 10 \times 9 \times 8 \times 7 \times 6 \times 120$

10^{10} :

$N!$ or N^N

$10!$

$N \rightarrow N$

$M \rightarrow M$

$\rightarrow N+M \rightarrow O(N+M)$

```
fun(n):
    s=0;
    for(i: 1→100):
        s=s+i;
    return s;
```

$O(1)$

100

```
fun(N):
    s=0
    i=0
    while(i<N)
        s=s+i
        i=i*2;
    return s;
```

Outer loop : $i : 1 \rightarrow N$

inner loop : $1 \rightarrow i$

i	j
0	1
1	2
2	3
3	4
4	5
N	N+1

$1 + 2 + 3 + 4 + \ldots + (N+1)$

$$\frac{(N+1)(N+2)}{2} = N^2 + \ldots$$

$$= O(N^2)$$

for (i : $1 \rightarrow 100$, $i \rightarrow i * 2$) $\rightarrow$ 6

for (j : 1 to N) $\rightarrow$ N

1 print:

$6 \times N \rightarrow O(N)$

log N	N^N	N!	2^N
1	4	3	2

$f_1 \rightarrow N \log N$

$f_2 \rightarrow N$

$f_3 \rightarrow N^2$

$f_4 \rightarrow \log N$

f_4, f_2, f_1, f_3

Output Prediction:

1.
```
function ex()
    for i( 1 → 6)
        if(i % 2 == 0)
            print (i, " is even");
```

2 is even
4 " "
6 " "

2.
```
fun1 () :
    print ("start")
    fun2 ()
    print ('End')

fun2 ():
    print ("Inside fun2");

fun1();
```

3.
```
fun loop():
    i=1;
    while (i< 10):
        print(i)
        i++;
```

4. func test():

print(x)

x=10

5. func offByOne(N):

for(i: 0 → N):

print i;

N=5 0, 1, 2, 3, 4, 5

⇓

Get everything clarified before proceeding.

```
void example() {
    x = 10;
    for (int i=1; i<=5; i++)
    {   x = x-2;
        if (x % 3 == 0)
        {   continue;
        }
        print(x);
    }
}
```

x = 10:

i	x
1	8
2	6
3	4
4	2
5	0

8 4 2

0 % N →

Q13:

```
fun():
    for (i=1; i!=10; i=i+2)
        print(i):
```

Q 14:

```
example() {
  for (i=1 ; i<=4 ; i++)
  {  if(i % 2 == 0 && i*2 <7)
     {   print (i);
     }
  }
}
```

i
1
2 ✓
3
4

Q 15