PYTHON PROGRAMMING
GATE DA/DSA

Agenda: GATE PYQs

GATE 2016

```
def f(p: list, n: int)->int:
  if n<=1:
    return 0
  else:
    return max(f(p[1:], n-1), p[0]-p[1])

a = [3,5,2,6,4]
print(f(a,5))
```

The value printed by the program is ___

a) 2
b) 3
c) 4
d) 5
e) None of these
f) Error

a = [3,5,2,6,4]
a[1:] = [5,2,6,4]

f(a, 5) → a = [3, 5, 2, 6, 4]

f(a, 5) → l_1 = [3, 5, 2, 6, 4]

$\boxed{f(a,5) \Rightarrow 3}$

max(f([5,2,6,4], 4), 3-5)

max(3, -2) → 3

a[1:

max(f([2,6,4], 3), 5-2)

max(2, 3) → 3

max(f([6,4], 2), 2-6)

max(2, -4) → 2

max(f([4], 1), 2)

0

max(0, 2) → 2

GATE 2015

Suppose c = (c[0].....c[k-1]) is an list of length k, where all the entries are from the set {0,1}. For any positive integers a and n, consider the following pseudocode.

```
DOSOMETHING(c, a, n)
z = 1

for i in range(0, k):
   do z = z^2 mod n
   if c[i] = 1
       then z = (z*a) mod n
return z
```

If k = 4, c = [1,0,1,1], a = 2 and n = 8, then the output of DOSOMETHING(c,a,n) is _________

~~a)~~ 0

b) $\underline{1}$

c) 2

d) 3

$c = [1, 0, 1, 1]$; $K = 4$

$a = 2$, $n = 8$

DOSOMETHING (c , a , n)

$z = 1$ 0 to $K - \underline{1}$

4 for i in range (0, k): $i = 0$

$z = z^2 \bmod n$ $z =$

if c[i] == 1 :

$z = (z * a) \bmod n$

return z

$z = 1$

$i = 0$: $z = 1^2 \bmod n = 1 \bmod 8 = \underline{1}$

if c[0] == 1

$z = (1 \times 2) \bmod 8$

$= 2 \bmod 8 = 2$

$\boxed{z = 2}$

$i=1$:

$z = z^2 \bmod n$

$= 4 \bmod 8 = 4$

if $c[i] = 1$:

$z=4$

$i=2$:

$z = z^2 \bmod n$

$= 16 \bmod 8 = 0$

$z=0$

if $c[i] = 1$

$z = (z \times a) \bmod n$

$= 0 \bmod 8 = 0$

$z=0$

$i=3$:

$z = z^2 \bmod n = 0$

if $c(i) = 1$

$z = (0 \times 2) \bmod 8 = 0$

$z = 0$

return z

0

```
a = 1000

def f(x=a):
  z = 10
  y = x*z
  print(y)

a = 5

f()
```

$x = a$

$x = 1000$

; $x = 5$

$y = 1000 * 10$

$y = 10000$

f( )

GATE 2015

```
x = 10

def f1():
  x = 25
  x += 1
  return x

def f2():
  x = 50
  def inner_f2():
    nonlocal x
    x += 1
    return x
  return inner_f2

def f3(y=x):
  z = y*10
  return z

x = 1
call_f2 = f2()

x += (f1()+call_f2()+f3()+call_f2())
print(x)
```

function.

x = 1

call_f2 = f2( )

inner_f2

call_f2 = inner_f2

+

call_f2( )

x += (f1( ) + call_f2( ) + f3( ) + call_f2( ))

f1( ) → 26

call_f2( ) → 51

f3 → 100

call_f2( ) → 52

x += (26 + 51 + 100 + 52)

26
100
51
~~52~~

x += 229

$x = 1 + 229 = 230$

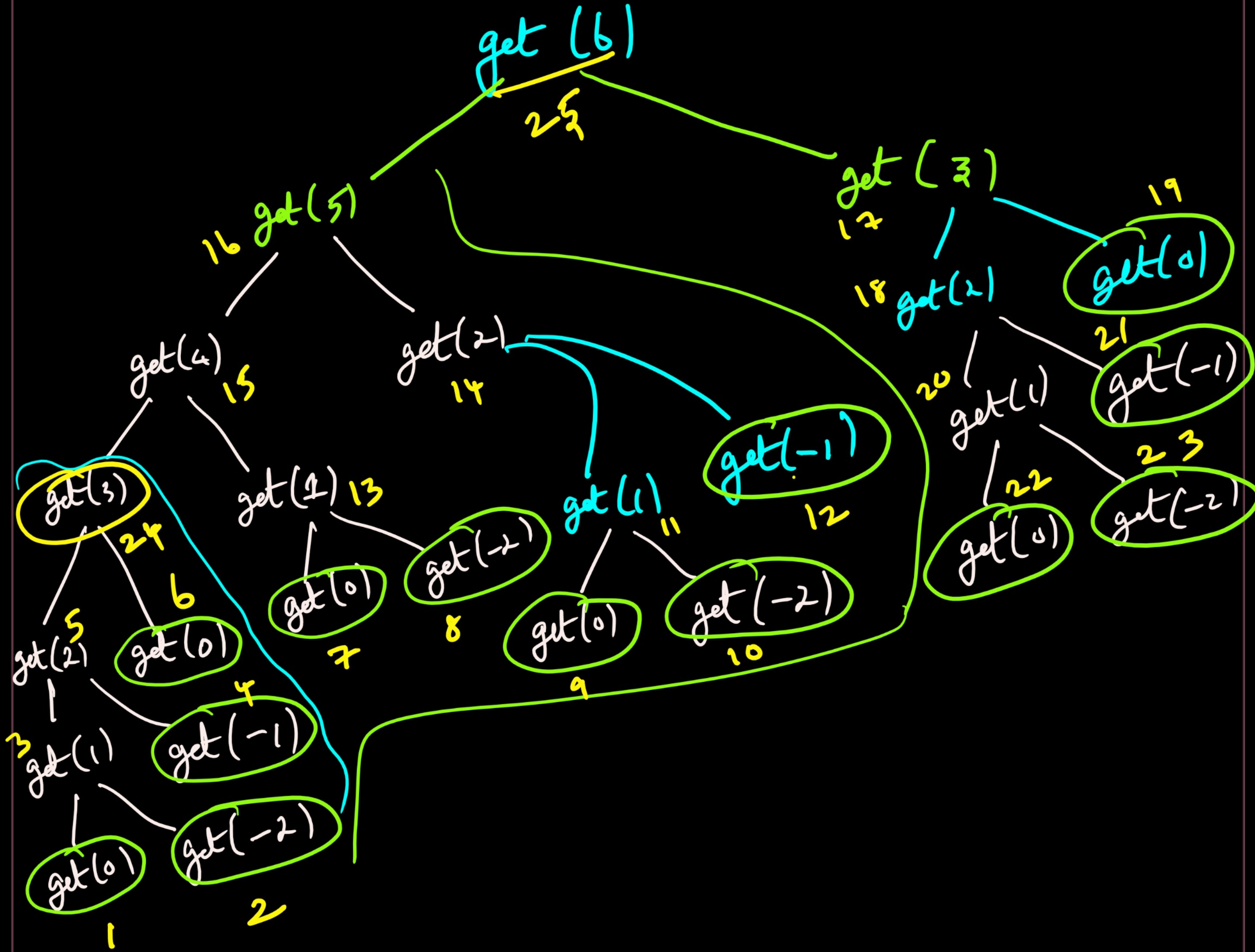
```
def get(n: int)->None:
  if n<1:
    return
  get(n-1)
  get(n-3)

get(6)
```

GATE 2015

If get(6) function is being called, then how many times will the get() function be invoked?

a) 15 b) 25 c) 35 d) 45

e) Infinite f) Error.



GATE 2015

```
def fun(n: int):
  x = 1
  if n==1:
    return x
  for k in range(1,n):
    x = x+fun(k)*fun(n-k)
  return x
```

The return value of fun(5) is ____

$1 : \underline{n-1}$

4

fun(5)

$fun(1) \longrightarrow 1$

fun(5)

$$\boxed{x = 1 + fun(1)\, fun(4) + fun(2) \cdot fun(3) + fun(3) \cdot fun(2) + fun(4) \cdot fun(1)}$$

1

$fun(1) \longrightarrow 1$

fun(2) :

$x = x + f(1) \cdot f(1)$

$= 1 + 1 \cdot 1$

$= 2 \quad x = 2$

$fun(2) \rightarrow 2$.

$fun(3)$:

$x = x + fun(1) \cdot fun(2) + fun(2) \cdot fun(1)$

$= 1 + 1 \times 2 + 2 \times 1$

$= 1 + 2 + 2$

$x = 5$

$\boxed{fun(3) \rightarrow 5}$

for k in range(1, 3): $k = 1, 2$

$x = \underline{x} + \underline{fun(k)} \cdot fun(n-k)$ $k = 1$

$x = 1 + fun(1) \cdot fun(2)$

$x = x + fun(2) \cdot fun(1)$

$1 + fun(1) \cdot fun(2) + fun(2) \cdot fun(1)$

$\underline{f(4)}$ ✓ $x(1,14)$

$f(4) = 15$

$x = 1 + fun(1) \cdot f(3) + fun(2) \cdot fun(2)$
$+ fun(3) \cdot fun(1)$

$x = 1 + 1 \times 5 + 2 \times 2 + 5 \times 1$

$= 1 + 5 + 4 + 5 = 15$

$fun(1) \to 1$
$fun(2) \to 2$
$fun(3) \to 5$
$fun(4) \to 15$

$fun(5)$

$x = 1 + fun(1) \cdot fun(4) + fun(2) \cdot fun(3)$
$+ fun(3) \cdot fun(2) + fun(4) \cdot fun(1)$

$= 1 + 1 \times 15 + 2 \times 5 + 5 \times 2$

$+ 15 \times 1$

$= 1 + 15 + 10 + 10 + 15$

$\boxed{fun(5) = 51}$

GATE 2014

Consider the following pseudo code. What is the total number of multiplications to be performed?

```
D = 2
for i=1 to n do
    for j =i to n do
        for k = j+1 to n do
            D = D*3
```

1

a) Half of the product of the 3 consecutive integers
b) one-third of the product of the 3 consecutive integers
c) one-sixth of the product of the 3 consecutive integers
d) None of these

i=1

for i in range (1, 5):

for j in range (5, 10):

D = D*2

5, 6, 7, 8, 9

4 × 5

$$\sum_{i=1}^{t} \sum_{j=5}^{9} 1$$

$$\boxed{\sum_{i=1}^{n} \sum_{j=i}^{n} \sum_{k=j+1}^{n} 1}$$

Total no. of multiplications that has to be performed.

$$T_n = \sum_{i=1}^{n} \sum_{j=i}^{n} \sum_{k=j+1}^{n} 1$$

$n = 5$

1 2 3 4 5

$j = 2$: $k = j+1$ to n

$k = 3, 4, 5$ $n-j$ $\rightarrow$ $n-j$ times.

$5-2$

$$T_n = \sum_{i=1}^{n} \sum_{j=i}^{n} (n-j)$$

$i = 1$ to n

range(1, n+1)

range(1, n)

1 to n-1

$$T_n = \sum_{i=1}^{n} \Big[(n-i) + (n-(i+1)) + (n-(i+2)) + \dots + (n-(n-3)) + (n-(n-2)) \Big)$$

$$+ (n-(n-1)) + (n-n)]$$

$$\boxed{T_n = \sum_{i=1}^{n} \frac{(n-i)(n-i+1)}{2}} \longrightarrow \cancel{2}$$

$n = 5$

$$\boxed{\sum_{i=1}^{3} (n-i)}$$

$$(n-1) + (n-2) + (n-3)$$

$$5-1 + 5-2 + 5-3$$

$$4 + 3 + 2 = 9$$

$$\sum_{j=i}^{n} (n-j)$$

i to n

$$\boxed{i, \quad i+1, \quad i+2, \; i+3, + \cdots, \; n-3, n-2, n-1, n}$$

$$n-i + n-(i+1) + n-(i+2) + n-(i+3)$$

$$+ \cdots + (n-(n-3) + n-(n-2)$$

$$+ n-(n-1) + n-n$$

$$1 + 2 + 3 + \cdots\cdots + (n-i)-3 + (n-i)-2 + (n-i)-1 + (n-i)$$

Sum of n numbers = $\frac{n(n+1)}{2}$

$$1 + 2 + 3 + \cdots + n \Rightarrow \frac{n(n+1)}{2}$$

$$1 + 2 + 3 + \cdots + (n-i) \Rightarrow \frac{(n-i)(n-i+1)}{2}$$

$$T_n = \frac{1}{2} \sum_{i=1}^{n} (n-i)(n-i+1)$$

$$T_n = \frac{1}{2} \sum_{i=1}^{n} n^2 - in + n - in + i^2 - i$$

$$= \frac{1}{2} \left[\sum_{i=1}^{n} n^2 + n + i^2 - 2in - i \right]$$

$$\boxed{T_n = \frac{1}{2} \sum_{i=1}^{n} n^2 + n + i^2 - i(2n+1)}$$

$$T_n = \frac{1}{2} \left[\sum_{i=1}^{n} n^2 + \sum_{i=1}^{n} n + \sum_{i=1}^{n} i^2 - i(2n+1) \right]$$

$$T_n = \frac{1}{2}\left[\underbrace{n^2 \sum_{i=1}^{n} 1}_{n^3} + \underbrace{n \sum_{i=1}^{n} 1}_{n^2} + \sum_{i=1}^{n} i^2 - (2n+1) \sum_{i=1}^{n} i\right]$$

$$n^2 \sum_{i=1}^{n} 1 = n^2 \left[\underbrace{1 + 1 + 1 + \cdots + 1}_{n \text{ times}}\right]$$

$$= n^2 [n] = n^3$$

$$n \sum_{i=1}^{n} 1 = n \left[\underbrace{1 + 1 + 1 \cdots + 1}_{n \text{ times}}\right]$$

$$= n^2$$

$$T_n = \frac{1}{2}\left[n^3 + n^2 + \sum_{i=1}^{n} i^2 - (2n+1) \sum_{i=1}^{n} i\right]$$

$$\sum_{i=1}^{n} i^2 = 1^2 + 2^2 + 3^2 + \cdots + n^2$$

$$= \frac{n(n+1)(2n+1)}{6}$$

$$\sum_{i=1}^{n} i = 1 + 2 + 3 + \cdots + n$$

$$= \frac{n(n+1)}{2}$$

$$T_n = \frac{1}{2}\left[n^3+n^2+\frac{n(n+1)(2n+1)}{6} - \frac{(2n+1)\,n\,(n+1)}{2}\right]$$

$$T_n = \frac{1}{2}\left[n^3+n^2+n(n+1)(2n+1)\left[\frac{1}{6}-\frac{1}{2}\right]\right]$$

$$= \frac{1}{2}\left[n^3+n^2+n(n+1)(2n+1)\left[\frac{1-3}{6}\right]\right]$$

$$= \frac{1}{2}\left[n^3+n^2-\frac{(n)(n+1)(2n+1)}{3}\right]$$

$$= \frac{n}{2}\left[n^2+n-\frac{(n+1)(2n+1)}{3}\right]$$

$$= \frac{n}{2}\left[n(n+1)-\frac{(n+1)(2n+1)}{3}\right]$$

$$= \frac{n}{2}\left[\frac{3n(n+1)-(n+1)(2n+1)}{3}\right]$$

$$= \frac{n}{6}\left[3n(n+1) - (n+1)(2n+1)\right]$$

$$= \frac{n(n+1)}{6}\left[3n - (2n+1)\right]$$

$$= \frac{n(n+1)}{6}\left[3n - 2n - 1\right]$$

$$= \frac{n(n+1)}{6}\left[n - 1\right]$$

$$= \frac{n(n+1)(n-1)}{6}$$

$\boxed{n-1,\ n,\ n+1}$

4, 5, 6

GATE CSE 2022.

Unicode Representation:

A	B	C	.....	Z
65	66	67	.....	90

a	b	c	.....	z
97	98	99	.....	122

*	+	−
42	43	45

z − 122
y − 121
x − 120

```
a = "P"  ⟶  80
b = "x"
c = ord (a and b) + ord ('*')
d = ord (a or b) + ord ('-')
e = ord (a) ^ ord(b) + ord ("+")

print (c, d, e)
```

A 65　　G 71　　N 78
B 66　　H 72　　O 79
C 67　　I　　　P 80
D 68　　J 7
E 69　　K 75
F 70　　L 76
　　　　M 77

$$C = ord(\underbrace{a \text{ and } b}) + ord(`*')$$

$$5 \text{ and } 8 \longrightarrow$$

$$\text{"p" and "x"} \Rightarrow x$$

$$C = ord(`x') + ord(`*')$$

$$= 120 + 42$$

$$\boxed{C = 162}$$

$$d = ord(a \text{ or } b) + ord(`-')$$

$$= ord(`p' \text{ or } `x') + ord(`-')$$

$$= ord(`p') + ord(`-')$$

$$= 80 + 45$$

$$\boxed{d = 125}$$

$$e = ord(a) \wedge ord(b) + ord(`+')$$

$$= ord(`p') \wedge ord(`x') + ord(`+')$$

$= 80 \wedge 120 + 43$

$4 = 80 \wedge 163$

$40 + 43 \rightarrow 83$

$120+43 \rightarrow 163$

$\boxed{80 \wedge 163}$

$1 \wedge 1 = 0$

$\text{or } 0 = 0$

128	64	32	16	8	4	2	1	
0	1	0	1	0	0	0	0	→ 80
1	0	1	0	0	0	1	1	→ 163
1	1	1	1	0	0	1	1	→ 243

128 64 32 16 2 1

$e = 243$