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# Doubt Clearing Session

Comprehensive Course on Operating System for GATE - 2024/25

**Vishvadeep Gothi** • Lesson 12 • May 3, 2023

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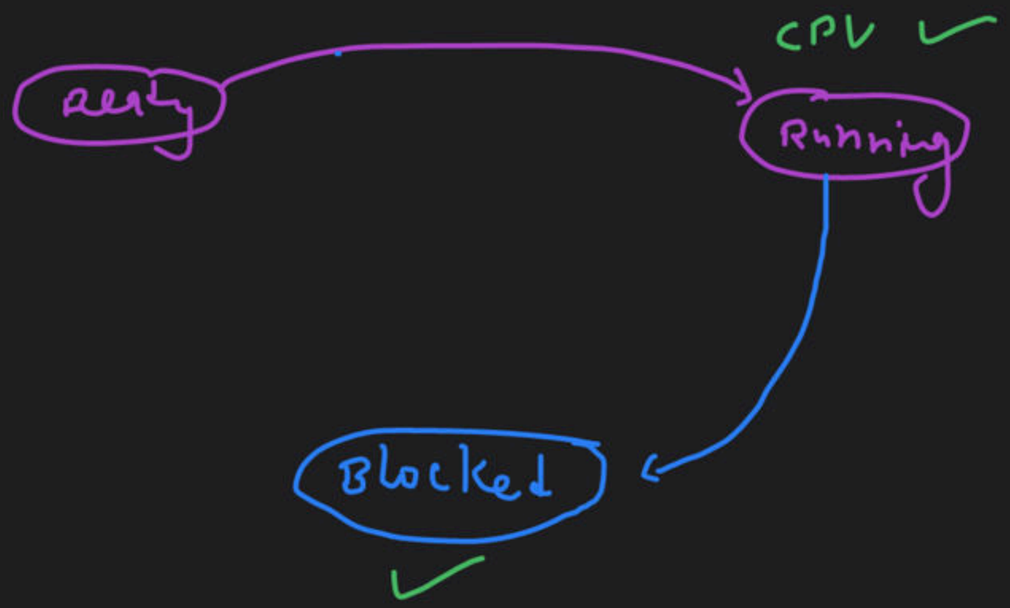
# Quiz :- 1

(1)



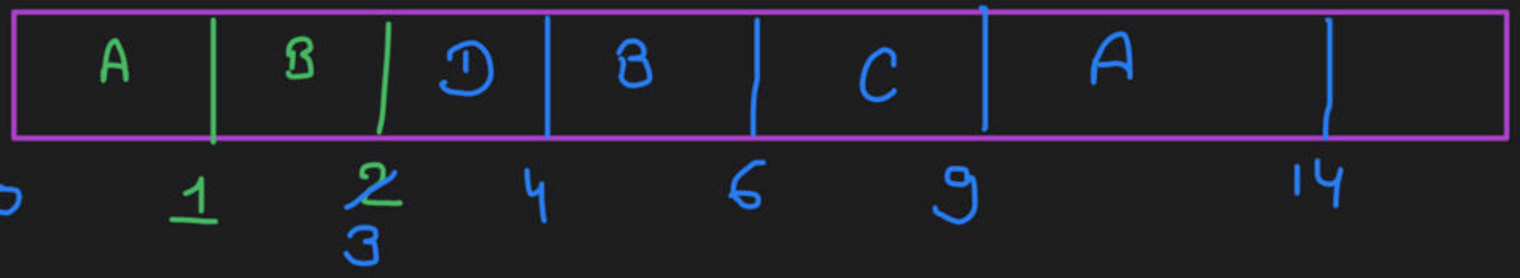

(2)

| | AT | BT |
|---|---|---|
| A | 0 | ~~6~~ ~~5~~ |
| B | 1 | ~~4~~ ~~3~~ ~~2~~ |
| C | 2 | ~~3~~ |
| D | 3 | ~~1~~ |

R.Q. ⇒ ~~A, B, C, D~~

0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1 + 0.1

14.7 Ans



3) 4 tasks

$T_1$ → infinite instances
$T_2$
$T_3$
$T_4$

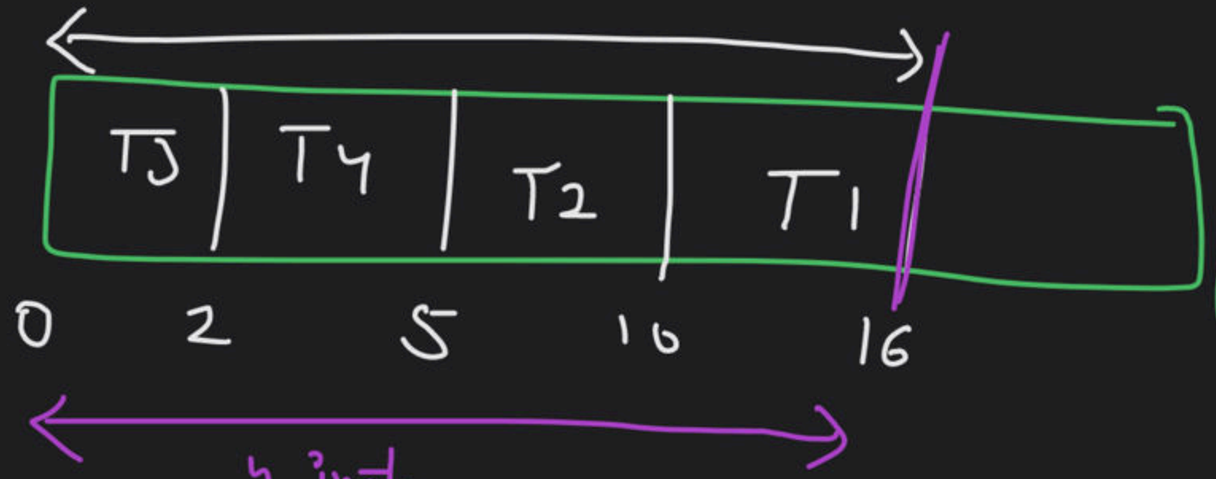
6 ✓
5 ✓
2 ✓
3 ✓

= 4 instances / per 16 msec

= 1/4 per msec

: 1000/4 sec

= 250 per sec




| | |
|---|---|
| $T_1$ | 0 |
| $T_2$ | 0 |
| $T_3$ | 0 |
| $T_4$ | 0 |

| | |
|---|---|
| $T_1$ | K |
| $T_2$ | K |
| $T_3$ | 16 |
| $T_4$ | 16 |

4) F

5) a, c

6) 7

| | AT | BT | CT | TAT |
|---|---|---|---|---|
| A | 0 | 6 | 11 | 11 |
| B | 0 | 5 | 16 | 16 |
| C | 2 | 2 | 8 | 6 |
| D | 5 | 4 | 17 | 12 |

| A | B | C | A | D | B | D |
|---|---|---|---|---|---|---|
| 0 | 3 | 6 | 8 | 11 | 14 | 16 | 17 |

| WT |
|---|
| 5 |
| 11 |
| 4 |
| 8 |

$$avg = \frac{28}{8} = 7$$

Q = 3

2.2. ⇒ ~~A~~, ~~B~~, C, A, D, B

▲ 2 • Asked by Rohit

sir 1-p^n smjh nhi aa rha mujhe ?


CPU utilization = $1 - p^2$


p * p * p

▲ 1 • Asked by Soumen

after lrtf which process has more no of context swtich?

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▲ 1 • Asked by Shreyas

Sir I compiled my quiz doubts and mistake I made ,please help me with the doubts that I mentioned.

```
Q1.Doubt:first IO then CPU or first CPU then IO at end their should be no difference.
Q2.Doubt:Answer should be 14.6 not 14.7 at end why their is need to add 0.1 coz question itself says ,scheduling is needed only when at least one process is there in ready queue.
Q3.Silly Mistake:marked ans in msec but it was asked in sec.
Q4.Correct
Q5.Silly Mistake:asked for FALSE I marked TRUE.
Q6.Correct

During test it shows no negative marking but marks were claculated with -ve marking.

My Learnings:
        Read question carefully.
        Submitted test before 3 min hoping all answers are correct,should have rechecked.
```

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▲ 1 • Asked by Piyush

Please help me with this doubt

**Question 32** WRONG

Consider $n$ processes sharing the CPU in a round-robin fashion. Assuming that each process switch takes $s$ seconds, what must be the quantum size $q$ such that the overhead resulting from process switching is minimized but, at the same time, each process is guaranteed to get its turn at the CPU at least every $t$ seconds ?

A. $q \leq \frac{t-ns}{n-1}$

B. $q \geq \frac{t-ns}{n-1}$

C. $q \leq \frac{t-ns}{n+1}$

D. $q \geq \frac{t-ns}{n+1}$

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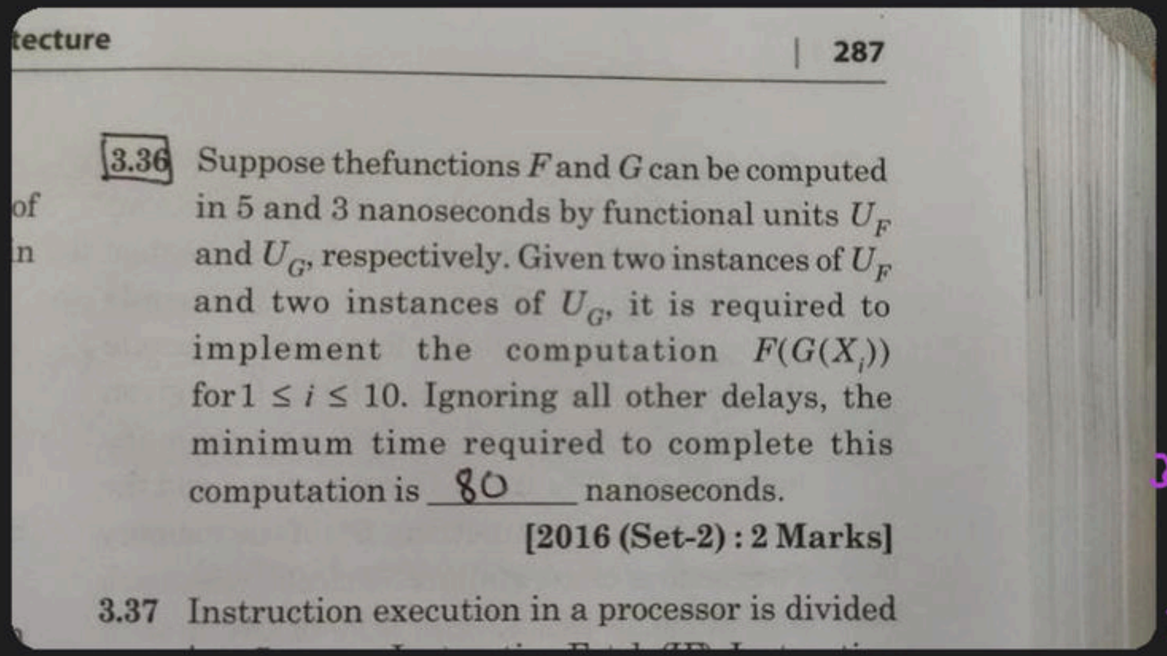
▲ 1 • Asked by Shreyas

Sir this question



tecture | 287

**3.36** Suppose the functions $F$ and $G$ can be computed in 5 and 3 nanoseconds by functional units $U_F$ and $U_G$, respectively. Given two instances of $U_F$ and two instances of $U_G$, it is required to implement the computation $F(G(X_i))$ for $1 \le i \le 10$. Ignoring all other delays, the minimum time required to complete this computation is 80 nanoseconds.

**[2016 (Set-2) : 2 Marks]**

**3.37** Instruction execution in a processor is divided

$F(G(x_i))$

10 inputs

$U_F \Rightarrow F \Rightarrow 5$ nsec

$U_G \Rightarrow G \Rightarrow 3$ nsec

| | G | F |
|---|---|---|
| $x_1, x_2$ | 3 | 8 |
| $x_3, x_4$ | 6 | 13 |
| $x_5, x_6$ | 9 | 18 |
| $x_7, x_8$ | 12 | 23 |
| $x_9, x_{10}$ | 15 | 28 |

Ans = 28

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▲ 1 • Asked by Shreyas

This should be 165 i think

Q. Consider an instruction pipeline with five stages without any branch prediction: Instruction Fetch (IF), Instruction Decode (ID), Operand Fetch (OF), Execute (EX) and Operand Write (OW). The stage delays for IF, ID, OF, EX and OW are 5 nsec, 7 nsec, 10 nsec, 8 nsec and 6 nsec, respectively.
There are intermediate storage buffers after each stage and the delay of each buffer is 1 nsec. A program consisting of 12 instructions I1, I2, ..., I12 is executed in the pipelined processor. Instruction I4 is the only branch instruction and its branch target is I9. If the branch is taken during the execution of this program, the time needed to complete the program is:
a. 132 nsec
b. 154nsec
c. 176 nsec
d. 328 nsec

6/13

Correct answer is (b).
Minimum clock period = max{5,7,10,8,6} + 1 = 11

```
I1:  IF ID EX ME WB
I2:  IF ID EX ME WB
I3:  IF ID EX ME WB
I4:  IF ID EX ME WB
I5:  . . . . .
I6:  . . . . .
I7:  . . . . .
I8:  . . . . .
I9:  IF ID EX ME WB
I10: IF ID EX ME WB
I11: IF ID EX ME WB
I12: IF ID EX ME WB
```

Total 14 clock cycles are needed, i.e. 14 x 11 = 154 nsec.



165

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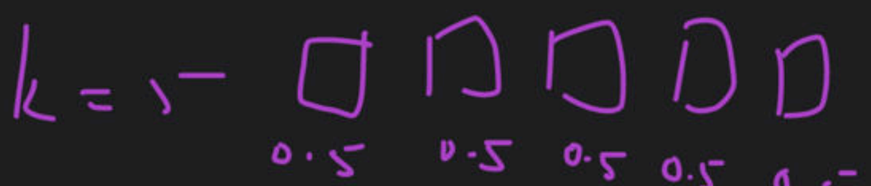
▲ 1 • Asked by Paarth S

An instruction takes 5 ns to get executed. A 5-stage pipleline is introduced and each stage has 0.5ns stage delay. What is the speed up?

$k * t_p \geq t_n$

$t_n = 5$ nsec

pipeline



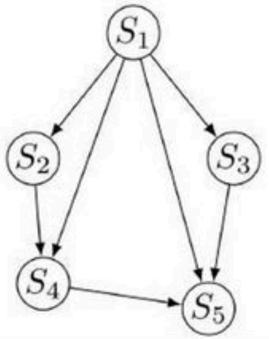

$\frac{5}{0.5} = 10$

▲ 1 • Asked by Vaishnavi

Please help me with this doubt

a. Four jobs are waiting to be run. Their expected run times are $6, 3, 5$ and $x$. In what order should they be run to minimize the average response time?

b. Write a concurrent program using par begin-par end to represent the precedence graph shown below.



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▲ 1 • Asked by Raghav

Hello Sir, I am working professional and I am managing time to prepare for gate, can you please tell me how much time in hours should I give in a day.

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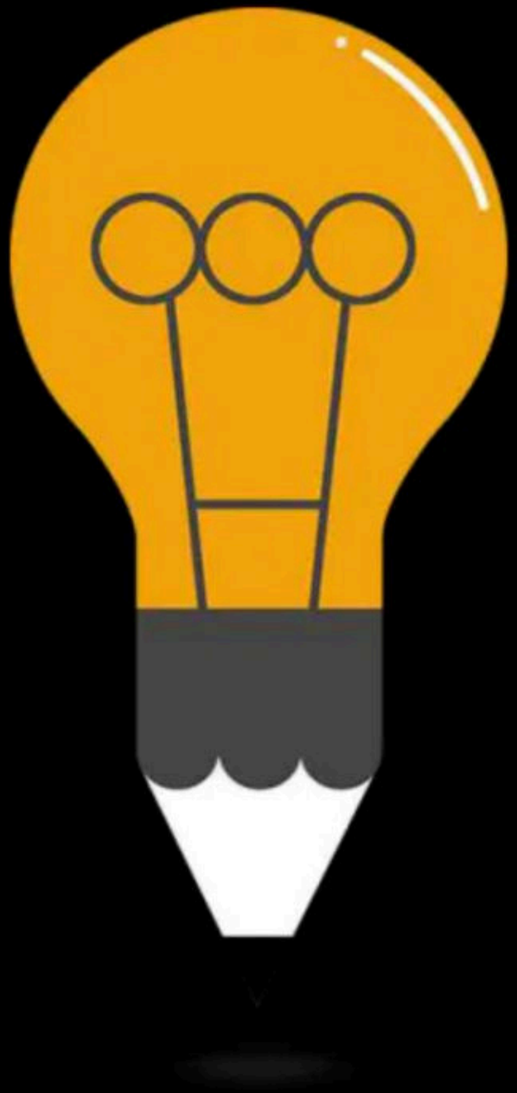

# Operating System
# Process Synchronization

By: Vishvadeep Gothi

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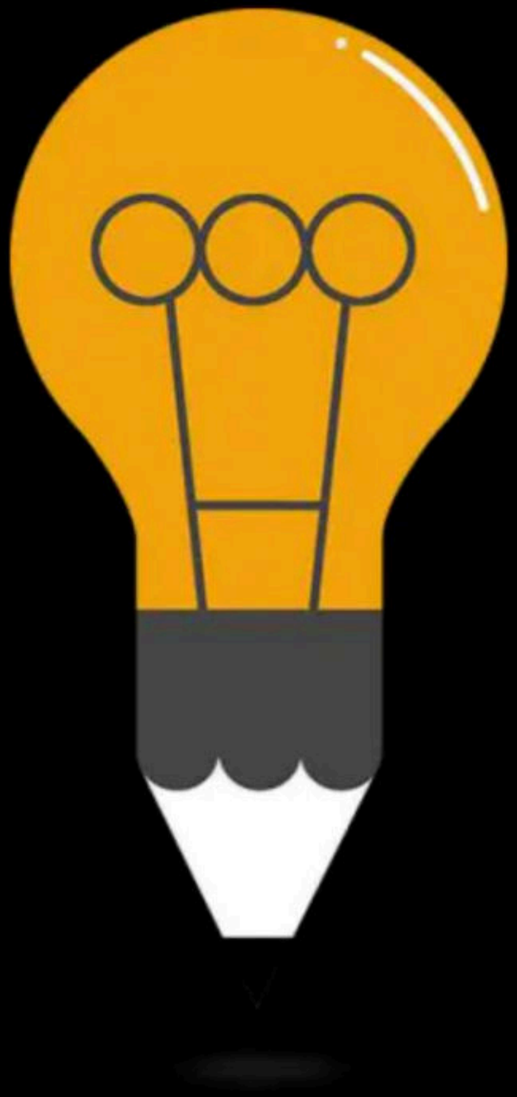

# DPP

By: Vishvadeep Gothi

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# Question 1

Consider a process scenario in which each process executes first in CPU then goes for IO operation, then once again process needs a CPU bursts and then terminates. Following is given a process scenario in which for CPU execution system uses non preemptive SJF algorithm. Consider system has enough number of resources to carry out IO operations for only 2 processes in parallel at a time. What is the average waiting time for the execution for the processes?

| Process | Arrival Time | CPU Burst Time | IO Burst Time | CPU Burst Time |
|---|---|---|---|---|
| P1 | 0 | 2 | 8 | 5 |
| P2 | 0 | 4 | 5 | 7 |
| P3 | 0 | 3 | 9 | 2 |
| P4 | 0 | 6 | 4 | 1 |

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# Question 2

Consider a process scenario in which each process executes first in CPU then goes for IO operation, then once again process needs a CPU bursts and then terminates. Following is given a process scenario in which for CPU execution system uses preemptive SRTF algorithm. Consider system has enough number of resources to carry out IO operations for all processes in parallel at a time. What is the average waiting time for the execution for the processes?

| Process | Arrival Time | CPU Burst Time | IO Burst Time | CPU Burst Time |
|---|---|---|---|---|
| P1 | 0 | 6 | 7 | 1 |
| P2 | 1 | 4 | 2 | 9 |
| P3 | 2 | 1 | 6 | 5 |

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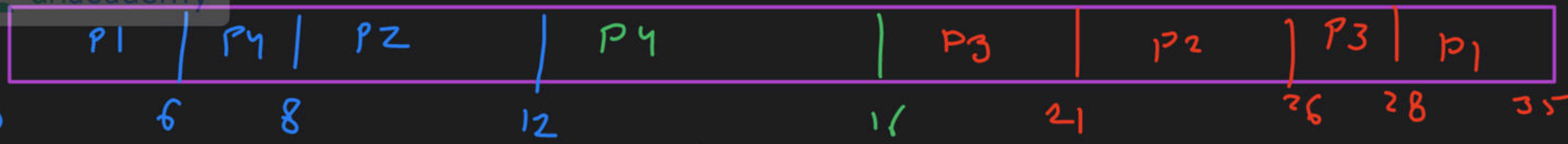
# Question 3

Consider a following process scenario in which each process first executes on CPU for given time duration then goes for IO operations and then again executes on CPU before termination. CPU uses non-preemptive SJF algorithm and consider each process has its separate set of IO devices to work in parallel with other process.

| Process | Arrival Time | Burst Time CPU | IO Time | Burst Time CPU |
|---|---|---|---|---|
| P1 | 0 | 6 | 4 | 7 |
| P2 | 1 | 4 | 3 | 5 |
| P3 | 2 | 5 | 5 | 2 |
| P4 | 4 | 2 | 2 | 4 |




P1 I/O

6 + 4 = 10

P2 I/O

12 + 3 = 15

P3

21 + 5 = 26

P1 I/O

8 + 2 = 10

At 15 :-

P3(5), P2(5), P1(7)

Ready Queue :-

P4(4), P3(5), P1(7)

P3(5), P1(7), P4(4)

P3(5), P1(7), P2(5)

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# Question 4

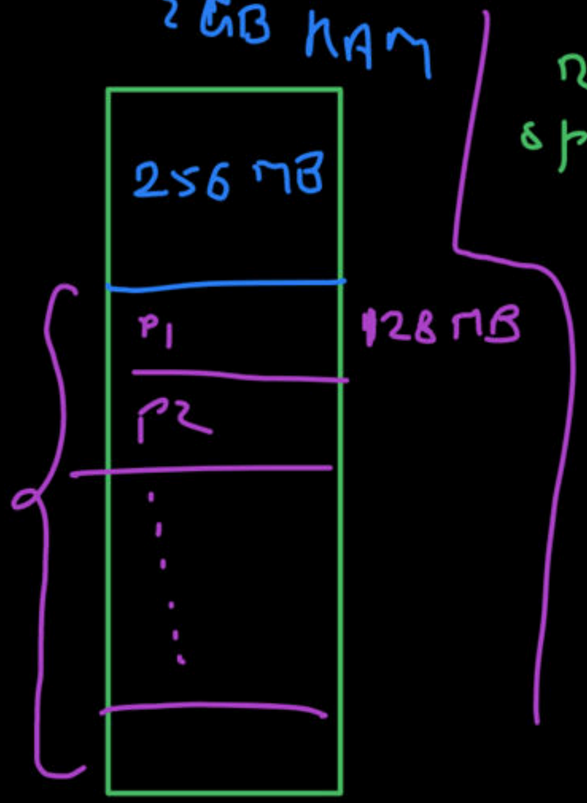
Multilevel Queue Scheduling, with fixed priority preemptive algorithm
Queue 1: RR with Q=2
Queue 2: SJF

| Process | Arrival Time | Burst Time | Queue |
|---|---|---|---|
| P1 | 0 | 3 | 1 |
| P2 | 1 | 3 | 2 |
| P3 | 2 | 5 | 2 |
| P4 | 1 | 4 | 1 |
| P5 | 11 | 4 | 2 |
| P6 | 15 | 3 | 1 |
| P7 | 16 | 2 | 1 |

# Question 5

E.S.E.

A computer system has 2GB of RAM and OS occupies 256MB of RAM. All the processes are of 128MB and have same characteristics. If the goal is 99% CPU utilization, then the maximum I/O wait that can be tolerated?




Rem. space for Processes $= 2GB - 256MB$

$$\text{no. of processes} = \frac{2GB - 256MB}{128MB}$$

$$= \frac{2GB}{128MB} - \frac{256MB}{128MB}$$

$$\frac{2^{31}}{2^{27}} - 2$$

$$= 14$$

$n = 14$

$$0.99 = 1 - p^{14}$$

$$p^{14} = 1 - 0.99$$

$$p^{14} = 0.01$$

$$p = 0.72 \text{ or } 72\%$$

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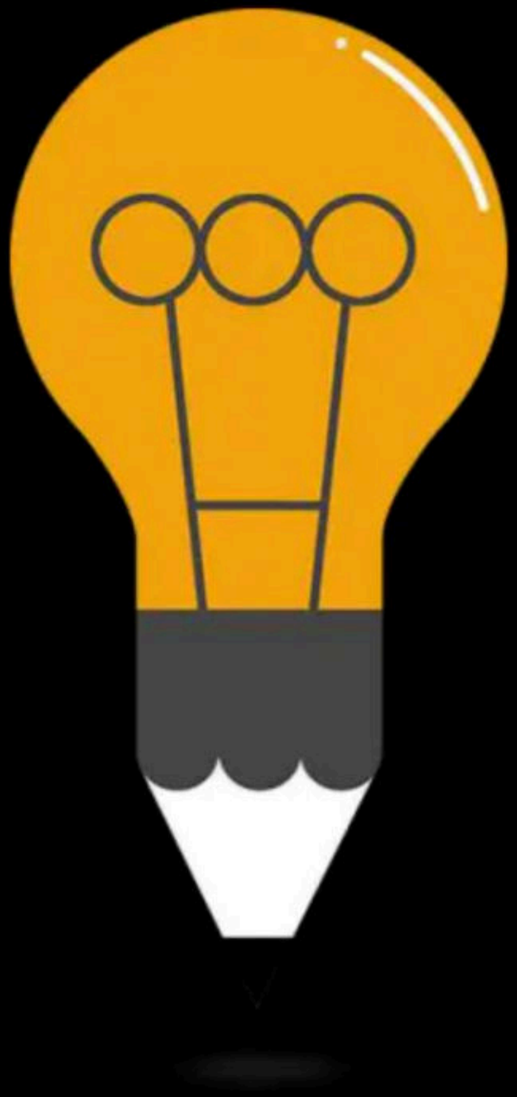

# DPP

By: Vishvadeep Gothi

# Question 1 GATE-2015

The following two functions $P1$ and $P2$ that share a variable $B$ with an initial value of $2$ execute concurrently.

```
P1() {
    C = B - 1;
    B = 2 * C;
}
```

```
P2(){
    D = 2 * B;
    B = D - 1;
}
```

The number of distinct values that $B$ can possibly take after the execution is _____.

B : 2

2
2
3

3

3, 4, 2

# Question 2 GATE-2019

Consider three concurrent processes P1, P2 and P3 as shown below, which access a shared variable D that has been initialized to 100.

| P1 | P2 | P3 |
|---|---|---|
| D = D + 20 | D = D – 50 | D = D + 10 |

The processes are executed on a uniprocessor system running a time-shared operating system. If the minimum and maximum possible values of D after the three processes have completed execution are X and Y respectively, then the value of Y – X is _____.

D = 100 → 50 → 120 → 130

min :-

D = 50

min = X = 50

max = Y = 130

Y - X = 130 - 50 = 80

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# Process Types

1. Independent
2. Cooperating/Coordinating/Communicating

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# Need Of Synchronization

# Problems Without Synchronization

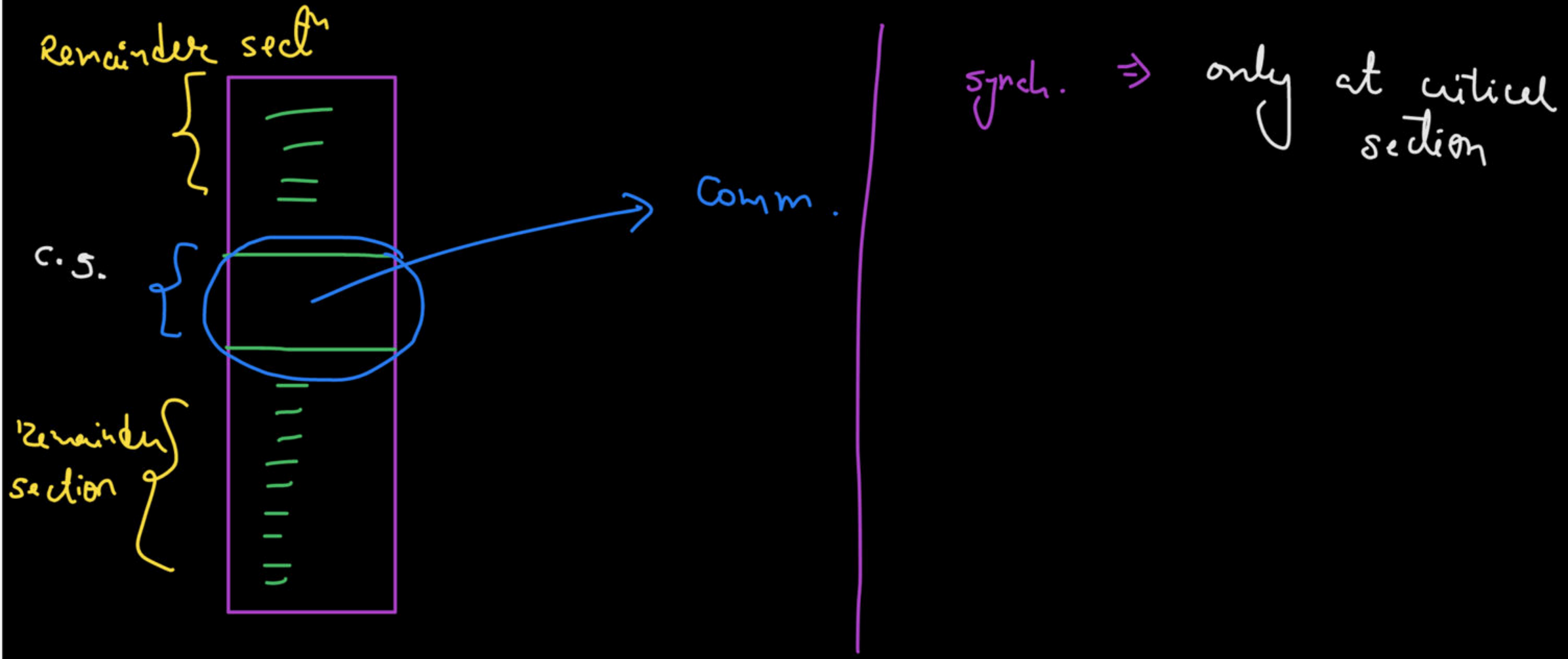
Problems without Synchronization:

- Inconsistency
- Loss of Data
- Deadlock

# Entire Process Requires Synchronization?

# Critical Section

The critical section is a code segment where the shared variables can be accessed



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# Race Condition

A race condition is an undesirable situation, it occurs when the final result of concurrent processes depends on the sequence in which the processes complete their execution.

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# Question

X = 10

P1
X = X /2

P2
X = X+4

How many different values of X are possible after both processes finish executing?

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# Question

The following pair of processes share a common variable X.

| Process A | Process B |
| --- | --- |
| int Y; | int Z; |
| Y = X*2; | Z = X+1; |
| X = Y; | X = Z; |

X is set to 4 before either process begins execution. As usual, statements within a process are executed sequentially, but statements in process A may execute in any order with respect to statements in process B.

How many different values of X are possible after both processes finish executing?

# Critical section problem :-

Problems due to execut$^{n}$ of critical section.

# Solution of Critical Section Problem

Requirements of Critical Section problem solution:

1. Mutual Exclusion
2. Progress
3. Bounded Waiting

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# 2-Process Solution

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# Solution 1

```
Boolean lock=false;
```

```
while(true)
{
   while(lock);
   lock=true;
     CS
   lock=false;
     RS;
}
```

```
while(true)
{
   while(lock);
   lock=true;
     CS
   lock=false;
     RS;
}
```

# Solution 2

```
int turn=0;
```

```
while(true)
{
   while(turn!=0);
     CS
   turn=1;
     RS;
}
```

```
while(true)
{
   while(turn!=1);
     CS
   turn=0;
     RS;
}
```

# Solution 3: Peterson's Solution

```
Boolean Flag[2];
int turn;
```

```
while(true) {
    Flag[0]=true;
    turn=1;
    while(Flag[1] && turn==1)
        CS
    Flag[0]=False;
        RS;
}
```

```
while(true){
    Flag[1]=true;
    turn=0;
    while(Flag[0] && turn==0)
        CS
    Flag[1]=False;
        RS;
}
```

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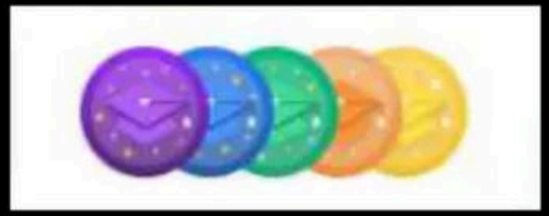
# Happy Learning.!



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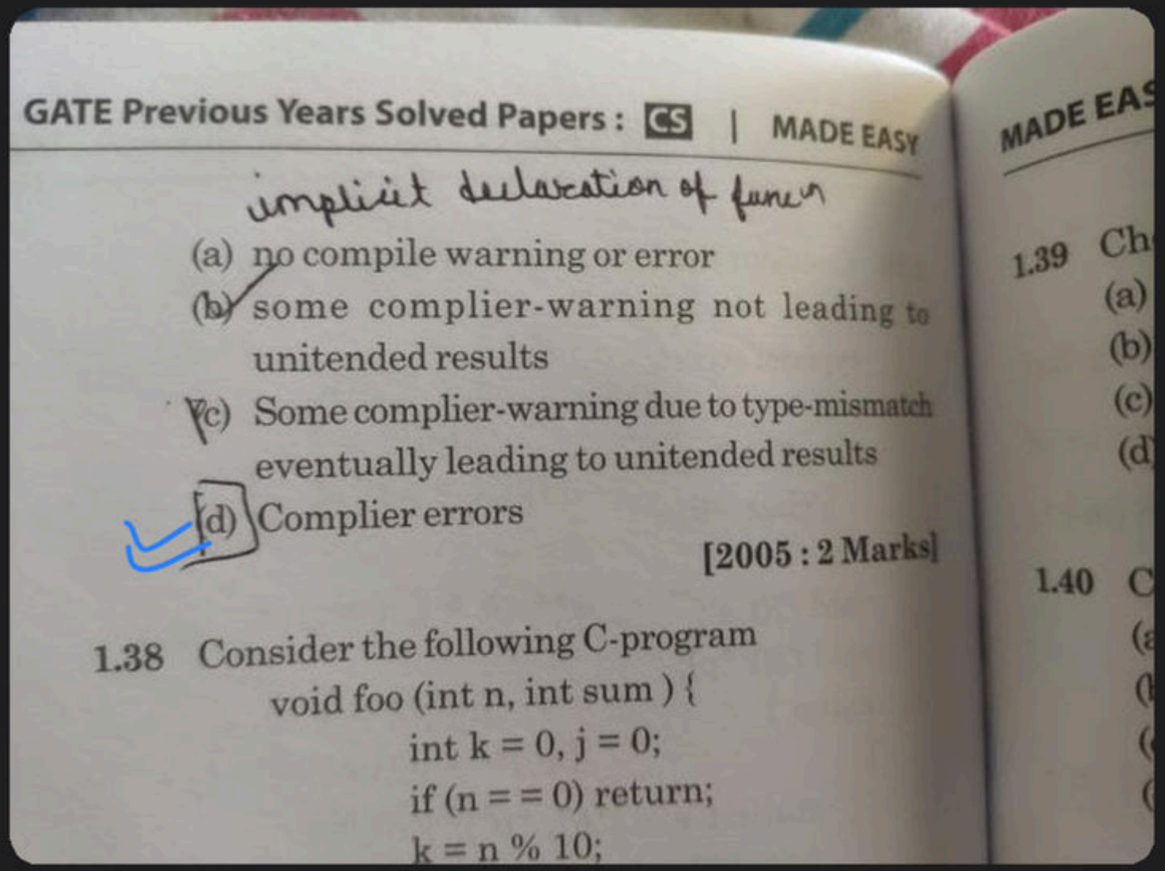
▲ 1 • Asked by Shreyas

Options



GATE Previous Years Solved Papers : CS | MADE EASY

implicit declaration of func

(a) no compile warning or error

(b) some complier-warning not leading to unitended results

(c) Some complier-warning due to type-mismatch eventually leading to unitended results

(d) Complier errors

[2005 : 2 Marks]

1.38 Consider the following C-program

```
void foo (int n, int sum ) {
    int k = 0, j = 0;
    if (n = = 0) return;
    k = n % 10;
```

MADE EAS

1.39 Ch

(a)

(b)

(c)

(d)

1.40 C

Return-type int

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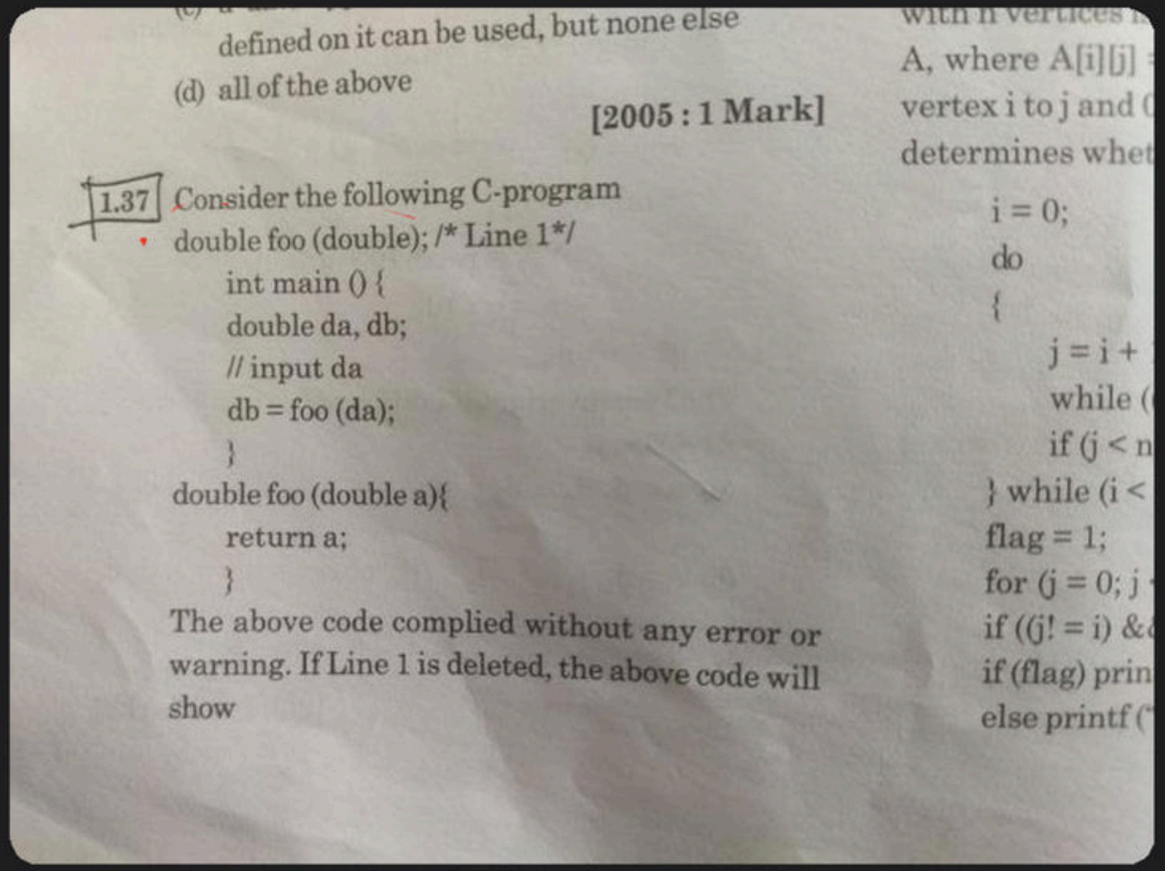
▲ 2 • Asked by Shreyas

And this too



defined on it can be used, but none else

(d) all of the above

**[2005 : 1 Mark]**

1.37 Consider the following C-program

```
double foo (double); /* Line 1*/
    int main () {
    double da, db;
    // input da
    db = foo (da);
    }
double foo (double a){
    return a;
    }
```

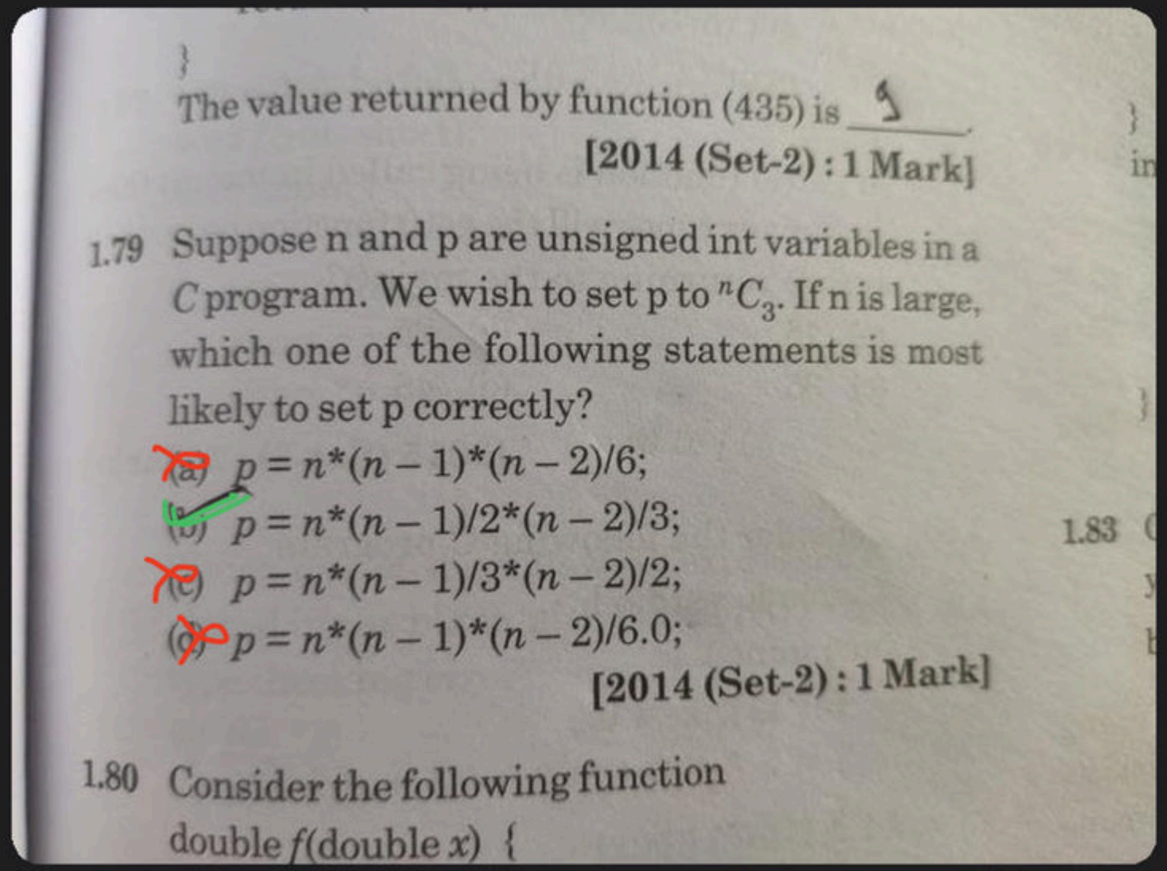
The above code complied without any error or warning. If Line 1 is deleted, the above code will show

with n vertices
A, where A[i][j]
vertex i to j and
determines whe

```
i = 0;
do
{
    j = i +
    while (
    if (j < n
} while (i <
flag = 1;
for (j = 0; j
if ((j! = i) &
if (flag) prin
else printf ("
```

▲ 2 • Asked by Shreyas

Sir nahi samjha ye wala



}

The value returned by function (435) is 5.

**[2014 (Set-2) : 1 Mark]**

1.79 Suppose n and p are unsigned int variables in a *C* program. We wish to set p to ${}^{n}C_{3}$. If n is large, which one of the following statements is most likely to set p correctly?

(a) $p = n*(n-1)*(n-2)/6;$

(b) $p = n*(n-1)/2*(n-2)/3;$

(c) $p = n*(n-1)/3*(n-2)/2;$

(d) $p = n*(n-1)*(n-2)/6.0;$

**[2014 (Set-2) : 1 Mark]**

1.80 Consider the following function

double *f*(double *x*) {

$n<3$

$$\frac{n*(n-1)*(n-2)}{3*2*1}$$

$$= \frac{2000*1999}{3}$$

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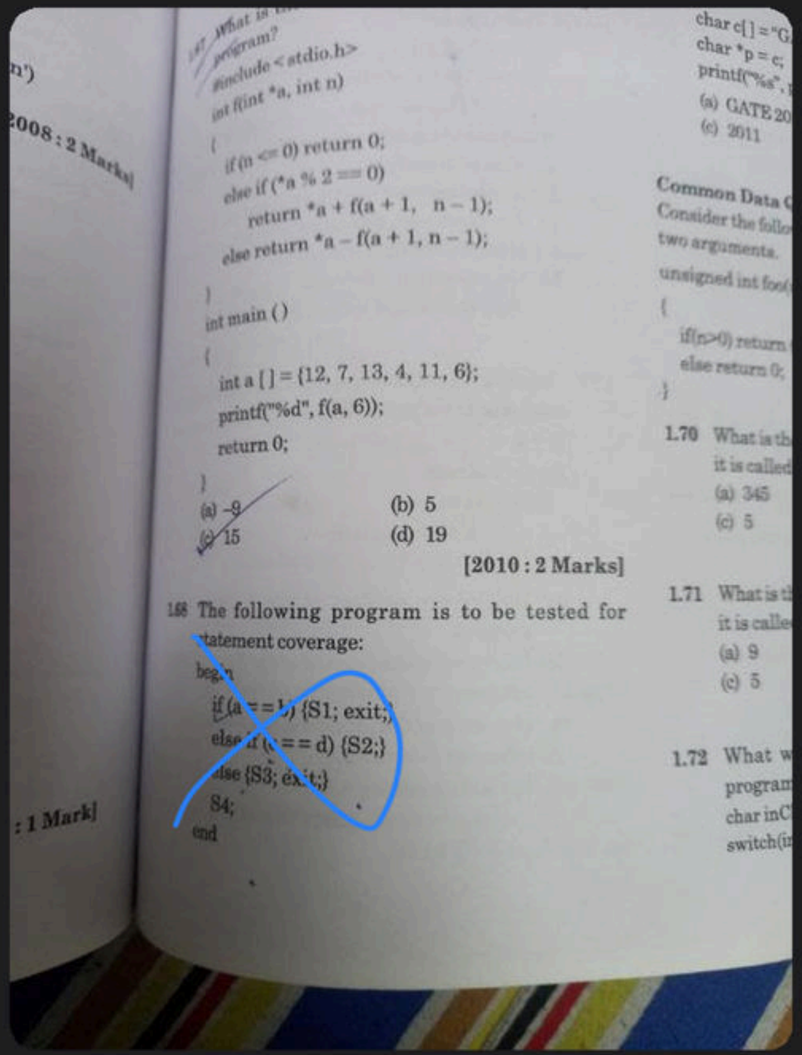
▲ 1 • Asked by Srivastava

Please help me with this doubt



```
#include <stdio.h>
int f(int *a, int n)
{
  if (n <= 0) return 0;
  else if (*a % 2 == 0)
    return *a + f(a + 1,  n - 1);
  else return *a - f(a + 1, n - 1);
}
int main ()
{
  int a [ ] = {12, 7, 13, 4, 11, 6};
  printf("%d", f(a, 6));
  return 0;
}
```

(a) –9 (b) 5
(c) 15 (d) 19

[2010 : 2 Marks]

168 The following program is to be tested for statement coverage:

```
begin
  if (a == b) {S1; exit;}
  else if (c == d) {S2;}
  else {S3; exit;}
  S4;
end
```

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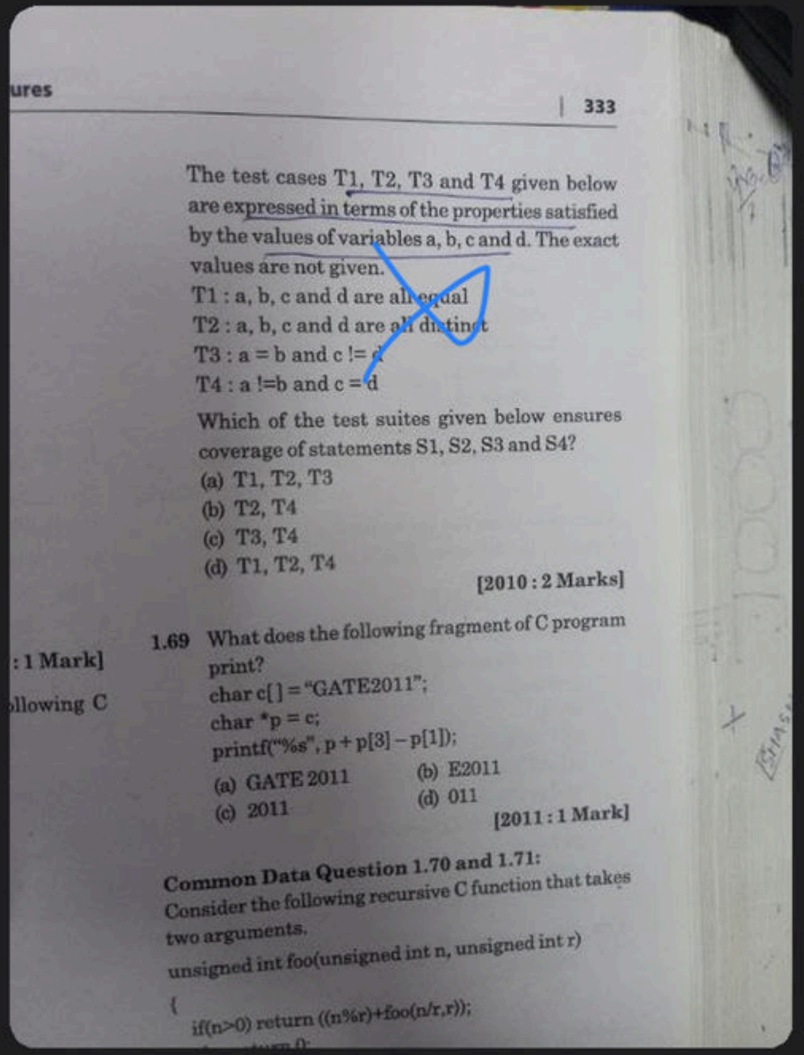
▲ 1 • Asked by Srivastava

Please help me with this doubt



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The test cases T1, T2, T3 and T4 given below are expressed in terms of the properties satisfied by the values of variables a, b, c and d. The exact values are not given.

T1 : a, b, c and d are all equal
T2 : a, b, c and d are all distinct
T3 : a = b and c != d
T4 : a !=b and c = d

Which of the test suites given below ensures coverage of statements S1, S2, S3 and S4?

(a) T1, T2, T3
(b) T2, T4
(c) T3, T4
(d) T1, T2, T4

**[2010 : 2 Marks]**

: 1 Mark]

llowing C

**1.69** What does the following fragment of C program print?

```
char c[ ] = "GATE2011";
char *p = c;
printf("%s", p + p[3] – p[1]);
```

(a) GATE 2011 (b) E2011
(c) 2011 (d) 011

**[2011 : 1 Mark]**

**Common Data Question 1.70 and 1.71:**
Consider the following recursive C function that takes two arguments.

```
unsigned int foo(unsigned int n, unsigned int r)
{
  if(n>0) return ((n%r)+foo(n/r,r));
```