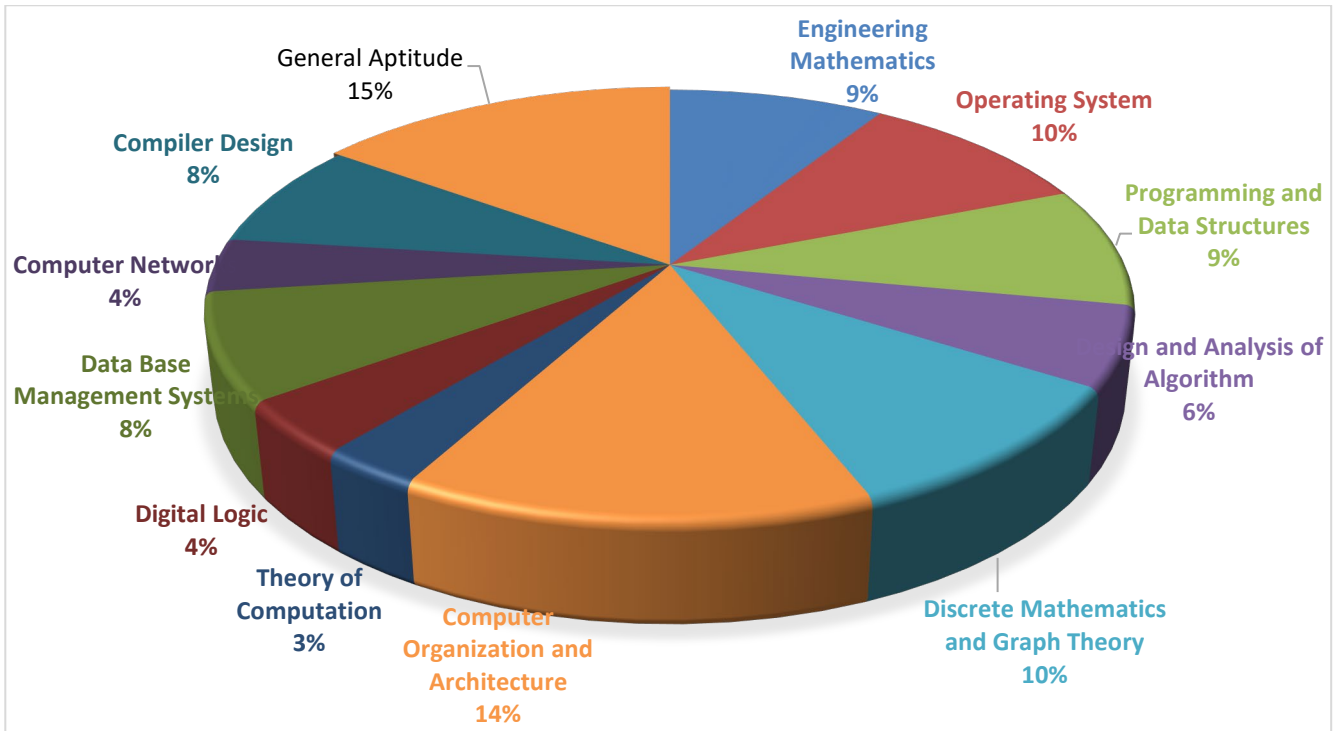




**ANALYSIS OF GATE 2020**  
Memory Based

Computer Science Engineering



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### CS ANALYSIS-2020\_Feb-08\_Afternoon

SUBJECT	No. of Ques.	Topics Asked in Paper(Memory Based)	Level of Ques.	Total Marks
Engineering Mathematics	1 Marks: 1 2 Marks: 4	Probability, Matrix, Calculus, Increasing function	Average	9
Operating System	1 Marks: 2 2 Marks: 4	-	Average	10
Programming and Data Structures	1 Marks: 3 2 Marks: 3	Min-heap, Binary tree, Linked lists	Average	9
Design and Analysis of Algorithm	1 Marks: 2 2 Marks: 2	Double Hashing, Recurrence, Relation, Worst case, Time complexity, Post-order traversal	Average	6
Discrete Mathematics and Graph Theory	1 Marks: 2 2 Marks: 4	Predicate Logic, Groups, Graph coloring, Minimum spanning tree	Average	10
Computer Organization and Architecture	1 Marks: 4 2 Marks: 5	-		14
Theory of Computation	1 Marks: 1 2 Marks: 1	Regular expression, minimal finite automata, decidability, context free language , regular language, deterministic push down automata	Difficult	3
Digital Logic	1 Marks: 2 2 Marks: 1	Memory, Decoder, Multiplexer	Average	4
Data Base Management Systems	1 Marks: 2 2 Marks: 3	ER diagram , Functional dependency(Normal form), SQL, B+ tree, Conflict equivalent	Average	8
Computer Networks	1 Marks: 2 2 Marks: 1	-		4
Compiler Design	1 Marks: 4 2 Marks: 2	Introduction, L-attribute bottom-up design	Average	8
General Aptitude	1 Marks: 5 2 Marks: 5	Geometry, English- Grammar, Permutation and Combination, Profit and Loss, Graph, Coding and decoding	Easy	15
<b>Total</b>	<b>65</b>			<b>100</b>
Faculty Feedback	Overall paper was average.			



## GATE 2020 Examination\* (Memory Based)

## Computer Science Engineering

Test Date: 8<sup>th</sup> Feb-2020

Test Time: 2.30 pm to 5.30 pm

Stream Name: Computer Science Engineering

## General Aptitude

Q.1 - Q.5 Carry One Mark each.

- Raman is confident of speaking English \_\_\_\_\_ six months. He has been practicing regularly \_\_\_\_\_ the last three weeks  
(A) During, for  
(B) For, since  
(C) Within, for  
(D) For, in  
[Ans. C]
- Select the word that fits the analogy  
Cook : Cook :: Fly : \_\_\_\_\_  
(A) Flighter  
(B) Flew  
(C) Flyer  
(D) Flying  
[Ans. C]
- His knowledge of the subject was excellent but his class room performance was \_\_\_\_\_  
(A) Extremely poor  
(B) Praise worthy  
(C) Desirable  
(D) Good  
[Ans. A]
- The number of permutations of the characters LILAC if no characters appears in its original position if two L's are indistinguishable is \_\_\_\_\_.

**Q.6 - Q.10 Carry Two Mark each.**

6. Goods & service tax (GST) in an indirect tax introduced in India in 2017 that is imposed on the supply of goods and services used, and it subsumes all indirect taxes except few. It is a destination based tax imposed on goods and services used, and it is not imposed at the point of origin from where goods come.

GST also has a few components specific to state government, central government and UT's?

Which one of the following can be inferred from given passage?

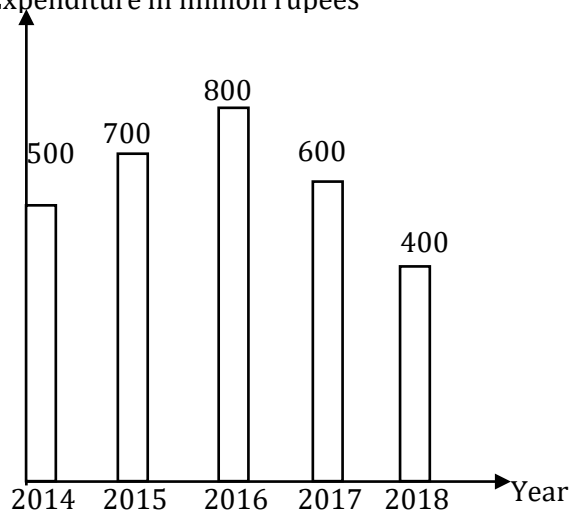
- (A) GST includes all indirect taxes  
(B) GST is imposed on the production of goods and services  
(C) GST imposed at point of usage of goods and services  
(D) GST does not have a component specific for UT's
7. If  $P = 3, R = 27, T = 243$ , then  $Q + S =$  \_\_\_\_\_  
(A) 80  
(B) 110  
(C) 90  
(D) 40

[Ans. C]

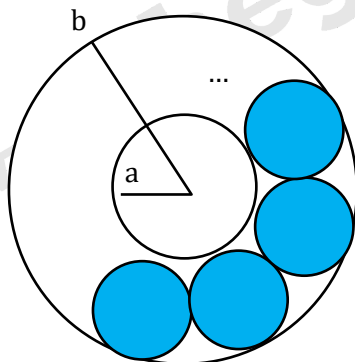
8. Two straight lines are drawn perpendicular to each other in XY plane. If  $\alpha$  and  $\beta$  are acute angles the straight lines make with x axis then  $\alpha + \beta =$  \_\_\_\_\_.  
(A)  $90^\circ$   
(B)  $180^\circ$   
(C)  $60^\circ$   
(D)  $120^\circ$

[Ans. A]

9. The total revenue of a company during 2014-2018 is shown in bar graph. The total expenditure of the company in each year is 500 million rupees. The aggregate profit/loss (in percentage) on the total expenditure of the company during 2014-2018 is \_\_\_\_\_



- (A) 16.67% loss  
 (B) 20% profit  
 (C) 20% loss  
 (D) 16.67% profit
- [Ans. D]
10. The figure below shows an annular ring with outer inner radii  $b$  and  $a$  respectively. The annular space has been painted in the form of blue colour circle touching the outer and inner peripheral of annular space. If maximum  $n$  number of circles can be painted then unpainted area available in annular space is \_\_\_\_\_.



- (A)  $\pi[(b^2 - a^2) - n(b - a)^2]$   
 (B)  $\pi[(b^2 - a^2) + \frac{n}{4}(b - a)^2]$   
 (C)  $\pi[(b^2 - a^2) + n(b - a)^2]$   
 (D)  $\pi[(b^2 - a^2) - \frac{n}{4}(b - a)^2]$

[Ans. D]



### Technical

Q.1 - Q.25 Carry One Mark each.

- Which of the following many-to-one roles of weak-entity set in an ER diagram?  
(A) Rectangles with double  
(B) Oval  
(C) Oval with double  
(D) Diamond  
[Ans. A]
- If there are  $m$  input lines and  $n$  output lines for a decoder that is used to uniquely address a byte addressable 1KB RAM then the minimum value of  $m$  and  $n$  is \_\_\_\_\_.  
[Ans. \*] Range: 8 to 8
- A multiplexer is placed between a group of 32 registers and an accumulator to regulate data moment such that at any given point in time the content of only one register will move to the accumulator the minimum number of select lines needed for multiplexer is \_\_\_\_\_.  
[Ans.\*]Range: 5 to 5
- Let  $G$  be a group of order 35. The size of largest possible subgroup, other than  $G$  itself is \_\_\_\_\_.  
[Ans. \*]Range: 7 to 7
- The number of permutations of the characters LILAC if no character appears in its original position if two L's are indistinguishable is \_\_\_\_\_.  
[Ans. \*]Range: 1 to 1
- Which one of the following functions are always increasing in  $(0, 1)$ ?  
(A)  $e^{-x}$   
(B)  $x^2 - \sin x$   
(C)  $\sqrt{x^2 + 1}$   
(D)  $e^x$

7.

Catalogue		
sno	pno	cost
S1	P1	50
S1	P2	50
S1	P3	100
S2	P4	200
S2	P5	250
S3	P1	250
S3	P2	150
S3	P5	300
S3	P4	250

Supplies		
sno	sname	loc
S1	RF	Delhi
S2	BF	Bangalore
S3	PF	Chennai

Parts		
pno	pname	part_spec
P1	T	W
P2	C	W
P3	T	S
P4	A	S
P5	A	W

SELECT S.sno, S.sname from Supplies S, Catalogue C WHERE S.sno = C.sno AND  
 cost > (SELECT Avg(cost) from Catalogue WHERE pno = 'P4' GroupBy pno);

[Ans. \*] Range: 4 to 4

8. The number of reduction steps taken by a bottom-up parser while accepting the string  
 aaadbbb

$S \rightarrow aSB|d$

$B \rightarrow b$

[Ans. \*] Range: 7 to 7

9. Which of the following statements are TRUE?

(i) Symbol table is accessed only during lexical analysis and syntax analysis

(ii) Compilers for programming L that support recursion necessarily need heap storage for  
 memory allocation in the runtime environment

(iii) Errors violating the condition any variable must be declared before its use are detected  
 during syntax analysis

(A) None of 1, 2, 3

(B) 1 and 3

(C) 2 only

(D) 1 only

[Ans. A]

10. Given  $L = \{a^n | n \leq 0\} \cup \{a^n b^n | n \geq 0\}$  Tell us where L is

(A) Deterministic context-free language

(B) Non-deterministic context free language

(C) Context-free language

(D) Context-free language but not deterministic CFL

[Ans. A]



11. Which of the following regular expression will contain set of all binary strings containing odd number of 1's

- (A)  $1 0^* (0^* 1 0^* 1 0^*)^*$
- (B)  $0^* (0^* 1 0^* 1 0^*)^* 1 0^*$
- (C)  $(0^* 1 0^* 1 0^*)^* 0^* 1$
- (D)  $((0 + 1)^* 1 + (0 + 1)^*) 1 0^*$

[Ans. C]

12. Double Hashing

$h_1 = K \bmod 23$  &  $h_2 = 1 + K \bmod 19$ , Table size = 23 & key value is 90. Check probe1 when probe 0 is the starting

[Ans. \*] Range: 13 to 13

13.  $T(n) = T\left(n^{\frac{1}{2}}\right) + 1; T(b) = 1$

- (A)  $O(\log_a \log_b n)$
- (B)  $O(\log_{ab} n)$
- (C)  $O(\log_b \log_a n)$
- (D)  $O(n^2)$

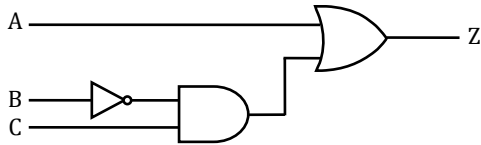
[Ans. A]

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Q.26 - Q.55 Carry Two Mark each.

26. Let A, B, C be the inputs which give output Z as shown in below figure. The minterms required to represent the output function  $Z(A, B, C)$  is \_\_\_\_\_.



- (A)  $\Sigma m(1, 3, 5, 6, 7)$   
 (B)  $\Sigma m(1, 4, 5, 6, 7)$   
 (C)  $\Sigma m(1, 2, 3, 6, 7)$   
 (D)  $\Sigma m(4, 5, 6, 7)$

[Ans. B]

27. Let A and B be two matrices. Rank (A) denotes rank of matrix A and  $\det(A)$  denotes determinant of matrix A, then consider the following statements:

1.  $\text{rank}(A B) = \text{rank}(A) \cdot \text{rank}(B)$
2.  $\det(A B) = \det(A) \cdot \det(B)$
3.  $\text{rank}(A + B) \leq \text{rank}(A) + \text{rank}(B)$
4.  $\det(A + B) \leq \det(A) + \det(B)$

Which of above statement is correct?

- (A) 2 and 3  
 (B) 3 and 4  
 (C) 1 and 2  
 (D) 1 and 4

28. Consider  $A \rightarrow PQ, A \rightarrow XY$  are production of a grammar P, Q, X, Y, A are non-terminals, s is synthesized attribute, i is inherited attribute

Rule 1:  $P.i = A.i + 2, Q.i = P.i + A.i, A.s = P.s + Q.s$

Rule 2:  $X.i = A.i + Y.s$  and  $Y.i = X.s + A.i$

Which of the following is TRUE?

- (A) Only Rule 1 is L attributed  
 (B) Rule 1 and Rule 2 are L attributed  
 (C) Neither Rule 1 Nor Rule 2  
 (D) Only Rule 2 is L attributed

[Ans. A]



29. Consider the codes given below for fun 2(5)?

```
fun 1(int n)
{
    static int i = 0;
    if(n > 0)
    {
        i ++;
        fun1(n - 1);
    }
    return (i);
}
fun2(int n)
{
    static int i = 0;
    if(n > 0)
    {
        i = i + fun1(n);
        fun2(n - 1);
    }
    return i;
}
```

[Ans. \*] Range 55 to 55

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30.

T <sub>1</sub>	T <sub>2</sub>
RA	
	RB
	WB
RC	
	RD
WD	
	WC
WB	
Commit	
	Commit

(A)

T <sub>1</sub>	T <sub>2</sub>
	RB
	WB
	RD
RA	
RC	
WD	
WB	
	WC
Commit	
	Commit

(B)

T <sub>1</sub>	T <sub>2</sub>
RA	
RC	
WD	
	RB
	WB
	RD
WB	
	WC
Commit	
	Commit

(C)

T <sub>1</sub>	T <sub>2</sub>
RA	
RC	
WD	
WB	RB
	WB
	RD
	WC
Commit	
	Commit

(D)

T <sub>1</sub>	T <sub>2</sub>
	RB
	WB
	RD
	WC
RA	
RC	
WD	
WB	
Commit	
	Commit

[Ans. A]

31. Relational schema R is in 3NF, but not in BCNF. Which of the following is true?
- (A) Non-trivial functional dependency  $x \rightarrow A$ , where x is not super key and A is Prime attribute
- (B) Non-trivial functional dependency  $x \rightarrow A$ , where x is super key and A is Prime attribute
- (C) Non-trivial functional dependency  $x \rightarrow A$ , where x is not a subset of key and A is Prime attribute
- (D) None of these

[Ans. A]

32. Which of the following is not valid?

- (A)  $\exists x (p(x) \rightarrow w) \equiv \forall x p(x) \rightarrow w$
- (B)  $\forall x (p(x) \rightarrow w) \equiv \forall x p(x) \rightarrow w$
- (C)  $\exists x (p(x) \wedge w) \equiv \exists x p(x) \wedge w$
- (D)  $\forall x (p(x) \vee w) \equiv \forall x p(x) \vee w$

[Ans. B]

33. Consider a graph  $K_{3,4}$  and a vertex S such that S is adjacent to every vertex of  $K_{3,4}$ . What is minimum color required to edge-color the graph?

34. Consider the following state changes for a preemptive scheduling OS:

- I. Ready to running
- II. Running to ready
- III. Blocked to running
- IV. Blocked to ready

Which of the above statement is correct?

- (A) I and II only
- (B) I only
- (C) I and III only
- (D) I, II and IV only

[Ans. D]

35. A new process needs to be allocated memory. The size of process cannot be exactly fit in available holes. If memory is allocated to any of the available holes, then a new smaller hole will be created. Which of the following option is correct in this context?

- (A) The size of hole created using best fit is never greater than size created by first fit
- (B) The size of hole created using best fit is never greater than size created by next fit
- (C) The size of hole created using next fit is never greater than size created by first fit
- (D) The size of hole created using worst fit is never greater than size created by first fit

[Ans. A]

36.  $L = \{x \mid x \in (0, 1)^+, \text{ number of } 0\text{'s in } x \text{ is divisible by } 2 \text{ but not by } 3\}$

What is the number of states in minimal DFA? \_\_\_\_\_

[Ans. \*] Range: 6 to 6

37. Given four languages, which of the following are undecidable?

Where  $\langle M \rangle$  denotes encoding of a Turing machine  $M$

$$L_1 = \{\langle M \rangle \mid L(M) = \emptyset\}$$

$$L_2 = \{\langle M, w, q \rangle \mid M \text{ will visit the state } q \text{ when } M \text{ execute on } w \text{ and take exactly } 100 \text{ steps}\}$$

$$L_3 = \{\langle M \rangle \mid L(M) \text{ is recursive}\}$$

$$L_4 = \{\}$$

Which one of the following are/in undecidable?

- (A)  $L_1 \& L_2$   
 (B)  $L_2 \& L_3$   
 (C)  $L_1 \& L_4$   
 (D)  $L_1, L_3 \& L_4$

[Ans. D]

38. Given two languages as shown below:

$$L_1 = \{wxyx \mid w, x, y \in (0, 1)^+\}$$

$$L_2 = \{xy \mid x, y \in (0, 1)^+, |x| = |y|, x \neq y\}$$

- (A)  $L_1$  is not regular but  $L_2$  is CFL  
 (B)  $L_1$  is CFL &  $L_2$  is not CFL  
 (C)  $L_1 \& L_2$  are not CFL  
 (D)  $L_1$  is regular &  $L_2$  is CFL

[Ans. C]

39. A min-heap is implemented using array representation. It has 1023 element than minimum number of search to determine maximum element in that heap.

40. Given vertices of undirected complete graph  $\{V_1, V_2, V_3, \dots, V_{100}\}$

Taken edge weight of  $(V_i, V_j)$  is  $|i - j|$ . Weight of MST?

[Ans. \*] Range: 99 to 99

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