

Computer Logics and Reasoning

Unit 1

1. Explain Floating point notation. [2017,2016,2015]
2. Convert 13010 into Octal Number system. [2017]
3. What is 2's complement? [2017,2015]
4. What is alphanumeric codes ?Explain EBCDIC Code. [2017]
5. Attempt any four
 - a. $(110101101)_2 \rightarrow (?)_{16}$
 - b. Subtract $(1101011)_2$ from $(11110110)_2$ using 2's complement. [2017]
 - c. $(ADF)_{16} \rightarrow (?)_{16}$
 - d. Multiply $(11010110)_2$ with $(11101)_2$
 - e. $(4656)_7 \rightarrow (?)_{12}$
 - f. What is Excess-3 code.
6. Multiply .1234 E-49 and .1111 E -52. [2016]
7. Simplify the Boolean expression. $Y=A'B'C'D'+A'B'C'D$. [2016]
8. Define homomorphism in Boolean algebra. [2016]
9. Let a,b be any elements of Boolean algebra,prove the following [2016]
 - i. $(a+b)'=a'b'$
 - ii. $(a*b)'=a'+b'$

OR

Define the following [2016]

 - I. Coding System [2016,2014,2013]
 - II. 2's Complement arithmetic [2016]
 - III. Error codes. [2015,2014]
10. Add .4546 E3 and .5433 E7 [2015]
11. Write full form of ASCII [2015]
12. Explain radix r representation of integers. Write 398 in radix [2017,2016,2015,2014,2013]
13. What is Radix r representation of integers? [2017,2016]
14. Covert $(246)_{10}$ into binary number system [2015]
15. Multiply .5543E12 and .4111E-15. [2014]
16. $(11)_{10} * (13)_{10}$ by converting into binary. [2014]
17. Define following:- [2014,2013]

Complement and property of Complement [2014,2013]
18. Let a,b,c be any elements in Boolean algebra Prove [2014]
 - a. Idempotent Laws
 - i. $a+a=a$
 - ii. $a*a=a$
 - b. Boundedness Laws
 - i. $a+1=a$
 - ii. $a*a=a$
 - c. Absorption laws
 - i. $a+(a*b)=a$
 - ii. $a*(a+b)=a$
 - d. Associative laws
 - i. $(a+b)+c=a+(b+c)$
 - ii. $(a*b)*c=a*(b*c)$

OR

If the normalization on floating point is carried out at each stage, prove the following: [2014]

- a) $a(b-c) \neq ab-ac$ where $a=.5555E1$, $b=.4545E1$, $c=.4535E1$
- b) $(a+b)-c \neq (a-c)+b$ where $a=.5665E1$, $b=.5555E-1$, $c=.5644E1$

19. Convert $(1101)_2$ by $(101)_2$ [2013]
 20. Subtract $(01)_2$ from $(110)_2$ [2013]
 21. Add $(4)_{10}$ and $(5)_{10}$ in excess 3 code. [2013]
 22. Show that $(123)_8 \rightarrow (83)_{10} \rightarrow (1010001)_2$ [2013]
 23. If a and b are arbitrary element of a Boolean algebra, then show that [2013]
 - a. $(a+b)' = a' \cdot b'$
 - b. $(a \cdot b)' = a' + b'$
 - c. $a + (b \cdot c) = (a \cdot b) \cdot c$
 - d. $a \cdot (b \cdot c) = (a \cdot b) \cdot c$
 - e. $a + (a \cdot b) = a$
- OR
- i. Convert $(4653)_{10}$ to its binary equivalent.
 - ii. Convert $(110111001010110)_2$ to octal equivalent.
 - iii. Convert $(AF6)_{16}$ to its equivalent.
 - iv. Convert $(ABC.16)_{16}$ to its Octal equivalent. [2013]
 - v. $(CD42)_{16} \rightarrow (?)_{10} \rightarrow (?)_2$

Unit 2

1. Define conditional statement with example. [2017]
2. What is tautology ? Show that $(P \rightarrow Q) \leftrightarrow P' \vee Q$ is tautology [2017]
3. State well-ordering theorem. [2016]
4. Define tautology, contradiction and contingency. [2016]
5. Show that $(p \wedge (p \rightarrow q)) \rightarrow q$ is a tautology. [2016]
6. A) There are two shopping malls next to each other, one with sign board as 'Good items are not cheap', and second with sign board as 'Cheap items are not good'. Do they mean same. [2016]
 B) Obtain DNF of [2016]
 - i. $(p \rightarrow q) \wedge (p' \rightarrow q)$
 - ii. $(p \wedge (p \rightarrow q)) \rightarrow q$
7. Explain conditional statement $p \rightarrow q$ by truth table [2015]
8. Show that $\sim(p \vee (\sim p \wedge q))$ is logically equivalent to $\sim p \wedge \sim q$ [2015]
9. Test the validity of the following argument:- [2015]
 - a. If I try hard and I have talent, then I will become a musician. If I become a musician, then I will be happy. Hence if I will not be happy, then I did not try hard or I do not have talent. [2015]
10. Define tautology, contradiction and contingency. [2014]
11. Show that the statement $(p \rightarrow q)(\sim q \rightarrow \sim p)$ is a tautology. [2014]
12. Quantify the statement "Every student in the class studied calculus". [2014]
13. Obtain CNF of [2014]
 - a. $P \wedge (p \rightarrow q)$
 - b. $\sim(p \vee q) \leftrightarrow (p \wedge q)$
14. Determine the validity of the argument [2014]

'It is snowing today'.
 'It is snows today, then we will go skiing'.
 'Hence, we will go skiing'.
15. Prove that [2013]
 - a. $\sim(p \vee q) \equiv \sim p \vee \sim q$
 - b. $\sim(p \wedge q) \equiv \sim p \vee \sim q$
 - c. $\sim(p \rightarrow q) \equiv p \wedge \sim q$
 - d. $\sim(p \leftrightarrow q) \equiv p \leftrightarrow \sim q \equiv \sim p \leftrightarrow q$
 - e. $(p \leftrightarrow q) \equiv (p \rightarrow q) \wedge (q \rightarrow p)$
16. Test the validity of the following argument if it is good pen, then it is parker pen, it is a parker pen. Therefore it is a good pen. [2013]

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| 17. Define fallacy and tautology | [2013] |
| 18. What is conditional statements? | [2013] |

Unit 3

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| 1. What is Cartesian product? Explain with example. | [2017] |
| 2. Define power set of $A = \{a, b, c, d\}$ | [2017] |
| 3. Define Symmetric difference of two sets. | [2017] |
| 4. Explain union and intersection of two set using Venn Diagram | [2017] |
| 5. Define Cartesian product of $A = \{a, b\}$ $B = \{a, c, d\}$. | [2016] |
| 6. Define Power set of $S = \{1, 2, 3\}$. | [2016] |
| 7. For any sets A and B ,prove that | [2016] |
| i. $a) A \subset B \Leftrightarrow A \cap B = A$ | |
| ii. $b) A \subset B \Leftrightarrow A \cup B = B$ | |
| iii. $c) A - B = A \cap B^c - A^c$ | |
| 8. In a Class of 50 students, 15 play Tennis, 20 play Cricket and 20 play Hockey, 3 play Tennis & Cricket, 6 play Cricket & Hockey and 5 play Tennis & Hockey. 7 play no game at all. How many play Cricket, Tennis & Hockey? | [2016] |
| 9. Draw Venn diagram of $(A - B)'$ | [2015] |
| 10. Define disjoint sets with an example. | [2015] |
| 11. For any sets A, B and C prove the following mathematically. | [2016] |
| i. $i) (A - B) \cup (B - A) = A \cup B - A \cap B$ | |
| ii. $ii) (A - B) - C = A - (B \cup C)$ | |
| 12. For any 3 sets A, B and C Prove | [2015] |
| a. $A \cap (B - C) = (A \cap B) - (A \cap C)$ | |
| b. $A * (B \cap C) = (A * B) \cap (A * C)$ | |
| 13. A computer must hire 25 programmers to handle systems programming jobs and 40 for the application programming. Of the hired persons, 10 will have to do the jobs of both types. find how many programmers must be hired? | [2015] |
| 14. In a class of 90 students, each of whom has taken at least Maths or Computer or Science. It was Found 40 students having Maths, 50 having computer and 60 students having Science. 10 students have Maths & Computer, 40 Students have Maths & Science and 10 students have all the 3 subjects. Find the number of students who have Computer & Science but not Maths. | [2015] |
| 15. Define principle of duality in Set Theory. | [2014] |
| 16. Define Cartesian product of $A = \{a, b, c, d\}$ $B = \{1, 2, 3\}$ | [2014] |
| 17. Prove $(A' \cup B') = A' \cap B'$ | [2014] |
| 18. Let 100 of the 120 students of Maths at a college take at least one of the language Hindi, English and German. Also, let 65 study Hindi, 45 study study & German. If 20 study Hindi & English, 25 study English & German and 15 study Hindi & German. Find the number of students who study all 3 languages. [2014] | |
| 19. In a class of 50 students, 30 are studying Hindi, and 25 English language and 10 are studying both the languages .How many students are studying either language. | [2013] |
| 20. In a group of 52 person 16 drink tea but not coffee and 33 drink tea find. | |
| a. How many drink tea and coffee both. | |
| b. How many drink coffee but not tea. | [2013] |
| 21. Find power set of $A = \{a, b, c\}$ | [2013] |
| 22. Define universal and Power set. | [2013] |
| 23. Define ordered pair. | [2013] |

Unit 3

1. Define equivalence relation .Let $A=\{1,2,3,4,5\}$ and for any $a,b \in A$
 aRb if $a \leq b$ is equivalence relation or not. [2017]
 2. What is Hasse diagram? Let $A=\{1,2,3,9,18\}$ and for $a,b \in A$, aRb
 if a is divisible by a . Draw Hasse diagram for above relation. [2017]
 3. What is bounded lattice? [2017,2014]
 4. Solve the following recursion relation [2017]
 $Ar+5a_{r-1}+6a_{r-2}=42.4^r$
 Boundary condition: $a_2=278$ and $a_3=962$
 5. What is number of binary relations on a set with 'n' elements? [2016]
 6. Define partial order relation with example. [2016]
 7. Let R be the following relation on $A=\{1,2,3,4\}$ [2016]
 $R=\{(1,3),(1,4),(3,2),(3,3),(3,4)\}$
 i. Draw the directed graph of R .
 ii. Find RoR
 8. Solve the following recurrence [2016]
 $t_n=5t_{n-1}-6t_{n-2}$
 s.t. $t_n=7$ for $n=0$
 $t_n=16$ for $n=1$
 9. Let $X=\{2,3,6,12,24,36\}$ and the relation \leq be such $x \leq y$ if x divides y . Draw the Hasse diagram of (X, \leq) . [2016]
- OR
- If R and S be two equivalence relations in a set A , then prove that $R \cap S$ is also an equivalence relation. [2016]
10. Define minimal and maximal elements [2015]
 11. Define lattice [2015]
 12. Draw the diagram and matrix of the relation R defined on $A=\{1,2,3,4\}$ by
 $R=\{(1,1),(2,2),(2,3),(3,2),(4,2),(4,4)\}$ [2015]
 13. Let $A=\{1,2,3,4\}$ and $R=\{(1,2),(2,3),(3,4)\}$ be a relation defined on A .
 Find Symmetric, transitive closure. [2015]
 14. Explain following: [2015]
 a. Equivalence Class
 b. Linear Recursion Relation
 c. Homomorphism
 15. Define complemented lattice and prove that the dual of a complemented lattice is also a complemented lattice. [2015]
 16. Define equivalence classes with example. [2014]
 17. Define Binary Relation. [2014]
 18. Define Partial order Relation with example. [2014]
 19. Define bounded lattice. [2014]
 20. Let $x=\{2,3,6,12,24,36\}$ and the relation \leq be such that $x \leq y$ if x divided y . Draw the hasses diagram of $(x \leq y)$. [2014]
 21. Define the following:
 a. Graphical representation of Binary relation
 b. Compatible Universal. [2014,2013]
 22. Prove that if R is equivalence relation then R^{-1} is also an equivalence relation. [2013]
 23. Prove $avb=bva$ if (L,S) be a lattice. [2013]
 24. Define equivalence relation [2013]
 25. Define total order set and dual order set. [2013]

Unit 4

1. Let $F: (Q - \{3\}) \rightarrow Q$ be defined as $\therefore F(x) = (2x+3)/(x-3)$
 - a. for all $x \in (Q - \{3\})$. Then find whether f is one-one, onto or one-one into? [2017]
 - i. OR
 - b. A speaks truth in 75% cases and B in 80% cases. find the probability
 - c. that they are likely to contradict each other in stating the same fact. [2017]
2. Define injective function check given function f is injective or not. [2017]
 - a. $F: R \rightarrow R$ defined by $f(x) = 2x$ (for all $x \in R$)
3. Define composition of functions. [2015]
4. Given $A = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$ $B = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 1 \end{pmatrix}$ Find AVB . [2015]
5. Find the domain & range of $Y = \sqrt{9-x^2}$ [2014]