MAY 2024 **U/ID 32514/UCM5C**

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer any TEN questions.

1. Give an example for overlapping set.
2. If $U=\{2,3,4,5,6,7,8,9,10,11\}, A=\{3,5,7,9,11\}$ and $B=\{7,8,9,10,11\}$, Then find $(A-B)'$.
3. What is the function of divisibility?
4. What is an idempotent law?
5. What is disjunctive normal form?
6. Give an example for CNF.
7. What are the best methods of logic circuit simplification?
8. What is the switching theory of a circuit?
9. How do you solve sequence problems?
10. Find a recurrence relation and initial conditions for 1, 5, 17, 53, 161, 485....
11. What is closed walk?
12. Define Path.

PART B — ($5 \times 5 = 25$ marks)

Answer any FIVE questions.

13. Prove the following by Mathematical Induction: $1+3+5+\ldots+2n-1=n^2$.

14. Prove the following by Mathematical Induction:

$$1^2+2^2+3^2+\ldots\ldots+n^2=\frac{n(n+1)(2n+1)}{6}.$$

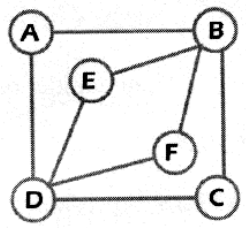
15. Determine the PDNF for the expression $\neg X \vee Y$.

16. Determine the PCNF for the expression $(\neg X \rightarrow Z) \wedge (Y \leftrightarrow X)$.

17. Simplify the expression $z = A\overline{B}\,\overline{C} + A\overline{B}C + ABC$.

18. Solve the recurrence relation $a_n = 3a_{n-1} + 2$ subject to $a_0 = 1$.

19. Determine whether this graph with 6 nodes contains an Euler circuit



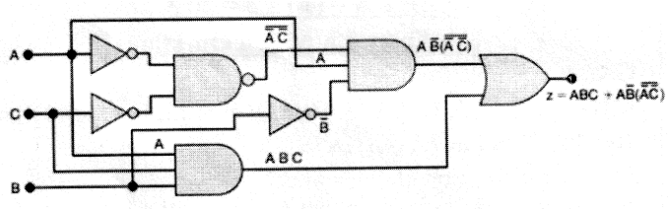
PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

20. Using the mathematical induction, prove that
$1\cdot 3+3\cdot 5+5\cdot 7+\cdots+(2n-1)(2n+1)=(1/3)$
$\{n(4n^2+6n-1)\}$

21. Obtain the PDNF and PCNF for the expression $X\rightarrow(Y\wedge X)\wedge(\neg X\rightarrow(\neg Y\wedge\neg Z))$.

22. Simplify the logic circuit

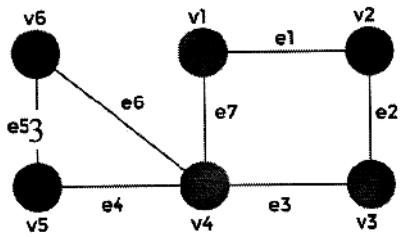


23. Solve the recurrence relation $a_n=2a_{n-1}-a_{n-2}$.

(a) What is the solution if the initial terms are $a_0=1$ and $a_1=2$?

(b) What do the initial terms need to be in order for $a_9=30$?

(c) For which x are there initial terms which make $a_9=x$?

24. 

Determine the nature of walk in each case:

(a) $v1, e1, v2, e2, v3, e2, v2$

(b) $v4, e7, v1, e1, v2, e2, v3, e3, v4, e4, v5$

(c) $v1, e1, v2, e2, v3, e3, e4, v4, e4, v5$

(d) $v1, e1, v2, e2, v3, e3, v4, e7, v1$.