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K16U 2586

ester B.Sc. Hon's (Mathematics) Degree (Reg./Supple./Improv.) Examination, November 2016

IM501 : ALGEBRA, ALGORITHMS & DATA STRUCTURES

ours

Max. Marks: 80

all the ten questions:

 $(10 \times 1 = 10)$

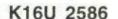
- (x) + g(x) and f(x). g(x) in $\mathbb{Z}_2[x]$ if f(x) = x + 1 and g(x) = x + 1.
- are the units in $\mathbb{Z}_7[x]$?
- true or false: a polynomial f(x) of degree n with coefficients in a field F can atmost n zeros in F.
- 4. Give an ideal for the ring \mathbb{Z} , the set of all integers.
- 5. What do you mean by a maximal ideal?
- 6. What do you mean by a queue?
- 7. Write any three data structure operations.
- 8. What is the complexity of a binary search algorithm?
- 9. Suppose multy dimensional arrays A and B are declared using A(-2:2, 2:22) and B(1:8, -5:5, -10:5). Find the length of each dimension.
- 10. Give examples for triangular and tridiagonal matrices.

Answer any 10 short answer questions out of 14.

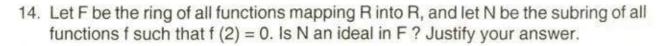
 $(10 \times 3 = 30)$

- 11. Prove that if D is an integral domain, then D[x] is an integral domain.
- 12. Factorize $x^4 + 3x^3 + 2x + 4$ in $\mathbb{Z}_5[x]$.
- 13. Show that $x^3 + 3x + 2$ is irreducible over \mathbb{Z}_5 .

P.T.O.







- 15. Let R be a ring with unity 1. Prove that the map $\phi \colon \mathbb{Z} \to R$ given by $\phi(n) = n.1$ for $n \in \mathbb{Z}$ is a homomorphism of \mathbb{Z} into R.
- 16. Show that the real number $\alpha = \sqrt{1 + \sqrt{3}}$ is algebraic over \mathbb{Q} . Also find deg (α, \mathbb{Q}) .
- 17. Find the degree and a basis for $\mathbb{Q}(\sqrt{2}, \sqrt{3}, \sqrt{18})$ over \mathbb{Q} .
- 18. What do you mean by worst case complexity of an algorithm ? What is the worst case complexity of linear search algorithm ?
- 19. Write bubble sort algorithm.
- 20. Write a note on big 'O' notation.
- 21. Write a note on subalgorithms.
- What do you mean by linear arrays? Write an algorithm for deleting an item from a linear array.
- 23. Write binary search algorithm to find the location of an ITEM in a sorted ARRAY.
- 24. Explain the representation of two dimensional arrays in memory.

Answer any 6 short answer questions out of 9.

(6×5=30)

- 25. Let F be a field of quotients of D and let L any field containing D. Then prove that there exists a map $\psi \colon F \to L$ that gives an isomorphism of F with a subfield of L such that $\psi(a) = a$ for $a \in D$.
- 26. State and prove Eisenstein Criterion.
- 27. If F is a field, then every nonconstant polynomial f(x) ∈ F[x] can be factored in F[x] into a product of irreducible polynomials, the irreducible polynomials being unique except for order and for unit factors in F.
- 28. If F is a field, prove that every ideal in F[x] is principal.





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- 29. Prove that the field C of complex numbers is an algebraically closed field.
- 30. Briefly explain the idea of complexity of an algorithm.
- 31. Write an algorithm to print the prime numbers less than N.
- 32. Consider the DATA:
 11, 22, 30, 33, 40, 44, 55, 60, 66, 77, 80, 88, 99.
 Apply binary search to DATA for searching the items 40 and 85.
- 33. Suppose A is a sorted array with 200 elements and suppose a given element x appears with the same probability in any place in A. Find the worst-case running time f(n) and the average-case running time g(n) to find x in A using the binary search algorithm.

Answer any one essay questions out of 2.

 $(1 \times 10 = 10)$

- 34. Let F be a field and let f(x) be a nonconstant polynomial in f(x). Prove that there exists an extension field E of F and an $\alpha \in E$ such that $f(\alpha) = 0$.
- 35. a) Explain control structures with examples.
 - b) Describe briefly the difference between local variables, parameters and global variables.