Punjab Technical University

Maximum Marks: 90   **Time: 90Mins.**

Entrance Test for Enrollment in Ph.D Programme

Important Instructions

➡ Fill all the information in various columns, in Capital letters, with blue/black point pen for attempting the questions
➡ Use of calculators is not allowed.
➡ Make attempt by writing the answer in capital Letters in the box against each question number.
➡ All questions are compulsory. Each Question has only one right answer. No Negative marking for wrong answers.
➡ Questions attempted with two or more options/answers will not be evaluated.

Stream:	......Engineering ....
Discipline	......Computer Science Engineering......
Name	....
Fathers Name	....
Date	...17-05-2015..
Roll Number	....
Signature of Candidate:	....
Signature of Invigilator	....

1. The following sequence of operation is performed on stack :
   push(1), push(2), pop, push(1), push(2), pop, pop, pop, push(2), pop.
   The sequence of popped out values are?
   A. 2,2,1,1,2
   B. 2,2,1,2,2
   C. 2,1,2,2,1
   D. 2,1,2,2,2

2. Suppose we're debugging a quicksort implementation that is supposed to sort an array in ascending order. After the first partition step has been completed, the contents of the array are in the following order: 3, 9, 1, 14, 17, 24, 22, 20. Which of the following statements is correct about the partition step?
   A. The pivot could have been either 14 or 17
   B. The pivot could have been 14, but could not have been 17
   C. The pivot could have been 17, but could not have been 14, 3.
   D. Neither 14 nor 17 could have been the pivot

3. When inorder traversing a tree resulted E A C K F H D B G; the preorder traversal would return
   A. FAEKCDBHG
   B. FAEKCDHGB
   C. EAFKHDCBG
   D. FEAKDCHBG

4. Given two sorted lists of size m and n respectively. The number of comparisons needed in the worst case by the merge sort algorithm will be?
   A. mn
   B. max(m,n)
   C. min(m,n)
   D. m+n-1

5. Which of the following is the last step in modelling class interactions, behaviours, and states that support the use-case scenarios?
   A. Transforming the "analysis" use cases to "design use cases
   B. Identifying class behaviour and responsibilities.
   C. Identifying and classifying use-case design classes
   D. Model object states.

6. _____is the measure of how well a solution meets the identified system requirements to solve the problem and take advantages of the opportunities envisioned for the system.
   A. operational feasibility
   B. technical feasibility
   C. schedule feasibility
   D. legal feasibility

7. In which of the following scheduling policies does context switching never takes place?
   A. Round-robin
   B. Shortest job first (non pre-emptive)
   C. Pre-emptive scheduling
   D. All of these

8. Formula for Effective Access Time is (Where, ma= memory access time, p=probability of page fault)
   A. (1-p) X ma + p X page fault time
   B. (1+p) X ma + p X page fault time
   C. (1-p)2 X ma + p X page fault time
   D. None of the Above

9. A multilevel page table is preferred in comparison to a single level page table for translating virtual address to physical address because
   A. it reduces the memory access time to read or write a memory location
   B. it helps to reduce the size of page table needed to implement the virtual address space of a process
   C. it is required by the translation look aside buffer
   D. it helps to reduce the number of page faults in page replacement algorithms

10. Spinlocks are
    A. CPU cycles wasting locks over critical sections of programs
    B. locks that avoid time wastage in context switches
    C. locks that work better on multiprocessor systems
    D. All of these given above

11. The number of processes completed per unit time is known as _____.
    A. Output
    B. Throughput
    C. Efficiency
    D. Capacity

12. The operating system maintains a _____ table that keeps track of how many frames have been allocated, how many are there, and how many are available.
    A. page
    B. mapping
    C. frame
    D. memory

13. Mutual exclusion implies that :
    A. if a process is executing in its critical section, then no other process must be executing in their critical sections
    B. if a process is executing in its critical section, then other processes must be executing in their critical sections
    C. if a process is executing in its critical section, then all the resources of the system must be blocked until it finishes execution
    D. None of these

14. Suppose that a bus has 16 data lines and requires 4 cycles of 250 nsecs each to transfer data. The bandwidth of this bus would be 2 Megabytes/sec. If the cycle time of the bus was reduced to 125 nsecs and the number of cycles required for transfer stayed the same what would the bandwidth of the bus?
    A. 1 Megabyte/sec
    B. 4 Megabytes/sec
    C. 8 Megabytes/sec
    D. 2 Megabytes/sec

15. Microprocessor 8085 can address location upto
    A. 32K
    B. 128K
    C. 64K
    D. 1M

16. The postfix expression for * + a b - c d is?
    A. ab + cd - *
    B. ab cd + - *
    C. ab + cd * -
    D. ab + - cd *

17. The maximum degree of any node in a simple graph with n vertices is
    A. n-1
    B. n/2
    C. n
    D. n-2
18. The searching technique that takes O (1) time to find a data is
    A. Linear Search
    B. Binary Search
    C. Hashing
    D. Tree Search
19. The data structure required for Breadth First Traversal on a graph is
    A. queue
    B. stack
    C. Array
    D. Tree
20. The wildcard in a WHERE clause is useful when?
    A. An exact match is necessary in a SELECT statement.
    B. An exact match is not possible in a SELECT statement.
    C. An exact match is necessary in a CREATE statement.
    D. An exact match is not possible in a CREATE statement.
21. Which of the following are the five built-in functions provided by SQL?
    A. COUNT, SUM, AVG, MAX, MIN
    B. SUM, AVG, MIN, MAX, MULT
    C. SUM, AVG, MULT, DIV, MIN
    D. SUM, AVG, MIN, MAX, NAME
22. Which of the following ensures the atomicity of the transaction?
    A. Transaction management component of DBMS
    B. Application Programmer
    C. Concurrency control component of DBMS
    D. Recovery management component of DBMS
23. Data independence allows
    (i) no changes in application programs
    (ii) change in database without affecting application programs
    (iii) hardware to be changed without affecting application programs
    (iv) system software to be changed without affecting application programs
    A. i, ii
    B. ii, iii
    C. ii, iii, iv
    D. i, ii, iv
24. Fourth normal form (4 NF) relations are needed when
    A. there are multivalued dependencies between attributes in composite key
    B. there are more than one composite key
    C. there are two or more overlapping composite keys
    D. there are multivalued dependency between non-key attributes

25. To use the service of UDP we need_____ socket address
    A. one
    B. two
    C. three
    D. four
26. If Ethernet port on a router were assigned an IP address of 172.16.112.1/25 what would be the valid subnet address of this host
    A. 172.16.0.0
    B. 172.16.112.0
    C. 172.16.96.0
    D. 172.16.255.0
27. Frame relay has error detection at the
    A. Physical layer
    B. Data Link Layer
    C. Network Layer
    D. Transport Layer
28. Determine the type of the following destination address FF:FF:FF:FF:FF:FF
    A. Unicast Address
    B. Broadcast Address
    C. Multicast Address
    D. None of the above
29. In which topology every device has a dedicated point to point link to every other device
    A. Bus
    B. Star
    C. Mesh
    D. None of the above
30. The size of MAC address and IPv4 address is
    A. 8 bits and 24 bits
    B. 32 bits and 48 bits
    C. 48 bits and 32 bits
    D. 24 bits and 32 bits
31. Which constructor function is designed to copy objects of the same class type?
    A. Create constructor
    B. Object constructor
    C. Dynamic constructor
    D. Copy constructor
32. Which of the following is not the member of class?
    A. Static function
    B. Friend function
    C. Const function
    D. Virtual function

33. Which of the following statement is correct?
    A. A reference is stored on heap
    B. A reference is stored on stack.
    C. Reference is stored in a queue.
    D. A reference is stored in a binary tree.
34. Which bitwise operator is suitable for turning on a particular bit in a number?
    A. && operator
    B. & operator
    C. || operator
    D. | operator
35. DeMorgan's first theorem shows the equivalence of
    A. OR gate and Exclusive OR gate
    B. NOR gate and Bubbled AND gate
    C. NOR gate and AND gate
    D. NAND gate and NOT gate
36. Which of the following statements is true?
    A. Every equivalence relation is a partial ordering relation.
    B. The number of relations from A={x,y,z} to B={1,2} is 64.
    C. The empty relation is reflexive.
    D. The properties of a relation being symmetric and being anti-symmetric are negatives of each other.
37. Suppose computers A and B have IP addresses 10.105.1.113 and 10.105.1.91 respectively and they both use the same net mask N. Which of the values of N given below should not be used if A and B should belong to the same network?
    A. 255.255.255.0
    B. 255.255.255.128
    C. 255.255.255.192
    D. 255.255.255.224
38. When too many packets are present in (apart of) the subnet, performance degrades and this situation is called
    A. Vector Routing
    B. Congestion
    C. Backward learning
    D. None of the above
39. A computer uses ternary system instead of the traditional binary system.An 'n' bit string in the binary system will occupy
    A. 3+n ternary digits
    B. 2n/3 ternary digits
    C. n(log(to the base 2)3) ternary digits
    D. n(log(to the base 3)2) ternary digits
40. Inherited attribute is a natural choice in
    A. Keeping track of variable declaration
    B. Checking for the correct use of L values and R values
    C. Both A and B

D. None of these

41. Which of the following is NOT an advantage of using shared, dynamically linked libraries as opposed to using statically linked libraries
    A. Smaller sizes of executable
    B. Lesser overall page fault rate in the system
    C. Faster program startup
    D. Existing programs need not be re-linked to take advantage of newer versions of libraries

42. Which of the following statements is false
    A. An unambiguous grammar has same left most and right most derivation
    B. An LL(1) parser is a top-down parser
    C. LALR is more powerful than SLR
    D. An ambiguous grammar can never be LR (K) for any k

43. Which of the following statements is false?
    A. The halting problem for Turing machines is undecidable
    B. Determining whether a context-free grammar is ambiguous is un-decidable
    C. Given two arbitrary context-free grammar, G1 and G2, it is undecidable with L(G1) = L(G2)
    D. Given two regular grammars G1 and G2, it is undecidable whether L(G1) = L(G2)

44. Which one of the following grammars generates the language $L = \{a^i b^j | i \neq j\}$.
    A. S → AC|CB; C → aCb|a|b; A → aA|ε; B → Bb|ε
    B. S → aS|Sb|a|b;
    C. S → AC|CB; C → aCb|ε; A → aA|ε; B → Bb|ε
    D. S → AC|CB; C → aCb|ε A → aA|aB → bB|b

45. Consider three problems P1, P2 and P3. It is known that P1 has polynomial time solution and P2 is NP-complete and P3 is in NP. Which one of the following is true.

    A. P3 has polynomial time solution if P1 is polynomial time reducible to P3
    B. P3 is NP complete if P3 is polynomial time reducible to P2
    C. P3 is NP complete if P2 is reducible to P3
    D. P3 has polynomial time complexity and P3 is reducible to P2

46. Let $\Sigma = \{a, b, c, d, e\}$. The number of strings in Σ^* of length 4 such that no symbol is used more than once in a string is
    A. 360
    B. 120
    C. 35
    D. 36

47. Which statement about TMs is correct?
    A. If L is decidable, then its complement is decidable
    B. If L is recognizable, then its complement is recognizable
    C. If L is enumerable, then its complement is enumerable
    D. All statements are false

48. PNF stands for
     A. Prenex Normal Form
     B. Predicate Normal Form
     C. Propositional Normal Form
     D. None of these

49. What will be the value of $((Q \rightarrow \sim P) \rightarrow (P \rightarrow \sim Q))$ in axiomatic system for propositional logic?
     A. P
     B. Q
     C. $P \rightarrow Q$
     D. $P \rightarrow \sim Q$

50. Consider the following propositions: P: It is hot. Q: It is humid. R: It will rain. Which of the following represents "If it is hot and humid, then it will rain."
     A. $P \wedge Q \rightarrow R$
     B. $P \vee Q \rightarrow R$
     C. $P \wedge Q \vee R$
     D. None of these

51. Given a method in a protected class, what access modifier do you use to restrict access to that method to only the other members of the same class?

     A. static
     B. final
     C. private
     D. protected

52. To create our own exception class , we have to _____
     A. Extend exception class
     B. Create our own try and catch block
     C. use finally block
     D. use catch block

53. Centralizing the integrity checking directly under the DBMS_____ Duplication and ensures the consistency and validity of the database
     A. Increases
     B. Skips
     C. Does not reduce
     D. Reduces

54. A functional dependency is a relationship between or among
     A. tables
     B. rows
     C. relations
     D. attributes

55. A relation is _____ if every field contains only atomic values that is, no lists or sets
     A. 1NF
     B. 2NF
     C. 3NF
     D. BCNF

56. Which of the following is correct
    A. a SQL query automatically eliminated duplicates
    B. SQL permits attribute names to be repeated in the same relation
    C. a SQl query will not work if there are no indexes on the relations
    D. None of these

57. Address is an example for _____ attribute?
    A. Relational
    B. Composite
    C. Hierarchical
    D. None

58. Each tuple in a relation must be _____; that is, there can be no duplicates?
    A. Relational
    B. Unique
    C. Hierarchical
    D. None

59. A system uses FIFO policy for page replacement. It has 4 page frames with no pages loaded to begin with. The system first accesses 100 distinct pages in some order and then accesses the same 100 pages but now in the reverse order. How many page faults will occur?
    A. 196
    B. 192
    C. 197
    D. 195

60. Let the time taken to switch between user and kernel modes of execution be t1 while the time taken to switch between two processes be t2. Which of the following is TRUE?
    A. t1 > t2
    B. t1 = t2
    C. t1 < t2
    D. Nothing can be said about the relation between t1 and t2

61. A thread is usually defined as a 'light weight process' because an operating system (OS) maintains smaller data structures for a thread than for a process. In relation to this, which of the followings is TRUE?
    A. On per-thread basis, the OS maintains only CPU register state
    B. The OS does not maintain a separate stack for each thread
    C. On per-thread basis, the OS does not maintain virtual memory state
    D. On per thread basis, the OS maintains only scheduling and accounting information.

62. Which of the following scheduling algorithms is non-preemptive?
    A. Round Robin
    B. First-In First-Out
    C. Multilevel Queue Scheduling
    D. Multilevel Queue Scheduling with Feedback

63. Consider a set of n tasks with known runtimes r1, r2, ... rn to be run on a uniprocessor machine. Which of the following processor scheduling algorithms will result in the maximum throughput?
   A. Round-Robin
   B. Shortest-Job-First
   C. Highest-Response-Ratio-Next
   D. First-Come-First-Served

64. A graphics card has on board memory of 1 MB. Which of the following modes can the card not support?
   A. 1600 x 400 resolution with 256 colours on a 17 inch monitor
   B. 1600 x 400 resolution with 16 million colours on a 14 inch monitor
   C. 800 x 400 resolution with 16 million colours on a 17 inch monitor
   D. 800 x 800 resolution with 256 colours on a 14 inch monitor

65. Which of the following expressions accesses the $(i,j)^{th}$ entry of an (m*n) matrix stored in column major form
   A. n*(i-1) +j
   B. m*(j-1)+i
   C. m*(n-j)+j
   D. n*(m-i) +j

66. A hash function f defined as $f(key)=key \bmod 7$, with linear probing, is used to insert the keys 37, 38, 72, 48, 98, 11, 56 into a table indexed from 0 to 6. What will be the location of key 11?
   A. 3
   B. 4
   C. 5
   D. 6

67. A machine took 200 sec to sort 200 names, using bubble sort. In 800 sec, it can approximately sort-
   A. 400 names
   B. 800 names
   C. 570 names
   D. 800 names

68. The number of edges in a regular graph of degree 'd' and 'n' vertices is
   A. Maximum of n,d
   B. n+d
   C. nd
   D. nd/2

69. A, B and C can do a piece of work in 20, 30 and 60 days respectively. In how many days can A do the work if he is assisted by B and C on every third day?
   A. 12 Days
   B. 15 Days
   C. 16 Days
   D. 18 Days

70. Here are some words translated from an artificial language.
    myncabel means saddle horse
    conowir means trail ride
    cabelalma means horse blanket
    Which word could mean "horse ride"?
    A. cabelwir
    B. conocabel
    C. almamyn
    D. conoalma

71. The minimum time will be taken by the algorithm of complexity
    A) $n(\log n)^3$
    B) $n/\log^2 n$
    C) $n^3 \log n$
    D) $n^2 \log^2 n$

72. In a Singly circular linked list organization, insertion of a record involves modification of
    A. One pointer
    B. Two pointers
    C. Three pointers
    D. Four pointer

73. What will be the result of last operation of given priority queue if number 1 is the highest priority
    Enqueue(3), Enqueue(6), Enqueue(2),dequeue, dequeue,
    Enqueue(5),Enqueue(1),dequeue, dequeue
    A. 3
    B. 6
    C. 2
    D. 5

74. Where an item with the largest key will be stored in a min heap
    A) at the root
    B) at any internal node
    C) at any external node
    D) at any node in the last level of the tree

75. The sequence 20, 15, 18, 7, 9, 17, 12, 3, 6, 2 is a max-heap.
    The sequence 20, 18, 15, 9, 7, 6, 5, 3, 2, 1 is a max-heap.
    A) True, True
    B) True, False
    C) False, True
    D) False, False

76. Maximum number of nodes in a binary tree of level k, k ≥ 1 is
    A) $2^k + 1$
    B) $2^k - 1$

C) 2^{k-1}
D) $2^{k-1} - 1$

77. A binary search tree is generated by inserting in order the following integers: 50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24
The number of nodes in the left sub-tree and right sub-tree of the root respectively is
A) (4, 7)
B) (7, 4)
C) (8, 3)
D) (3, 8)

78. Suppose that we have numbers between 1 and 1000 in a binary search tree, and we want to search for the number 363. Which of the following sequences could not be the sequences of nodes examined.
A) 2, 252, 401, 398, 330, 344, 397, 363
B) 924, 220, 911, 244, 898, 258, 362, 363
C) 925, 202, 911, 240, 912, 245, 363
D) 2, 399, 387, 219, 266, 382, 381, 278, 363

79. if v is the number of vertices, e is the number of edges and f is the number of faces (regions bounded by edges, including the outer region) of a planar graph then as per the Euler's Formula
A) v+f = 2+e
B) v+e= 2+f
C) e+f = 2+ v
D) e+v = f-2

80. Consider a simple connected graph G with n vertices and n edges (n>2). Then which of the following statements are true?
A) G has no cycles
B) The graph obtained by removing any edges from G is not considered connected
C) G has at least one cycle
D) The graph is a tree

81. Which out of the following properly defines chromatic number of a graph.
A) If a graph has been colored with K colors then K is the chromatic number of the graph.
B) The smallest Number of colors to be used to color a graph such that no two adjacent vertices have the same color.
C) Maximum number of colors to be used to color a graph such that no two adjacent vertices have the same color.
D) Maximum number of colors to be used to color a graph such that all cliques in the graph use different colors.

82. Greedy Technique is related to the theory of
A) Calculus
B) Probability
C) Matroid
D) Algebra

83. All the descendants of a node have a common _____ of the string associated with that node
   A) Value
   B) Height
   C) Prefix
   D) Suffix

84. What is the most common value of the Ackermann function in Union-Find Data structure with both the improvements.
   A) ≤ 8
   B) ≤ 2
   C) ≤ 5
   D) ≤ 100

85. Given a graph G = (V;E) with positive edge weights, the Bellman-Ford algorithm and Dijkstra's algorithm can produce different shortest-path trees despite always producing the same shortest-path weights. Reason?
   A) True
   B) False

86. If all edges in a graph have distinct weights, then the shortest path between two vertices is unique.
   A) True
   B) False

87. Adding same weight to all the graph edges keeps the shortest path intact?
   A) True
   B) False

88. What would prove that X is NP-hard?
   (A) Showing a polynomial-time reduction from 3-Sat to X
   (B) Showing a polynomial-time reduction from X to 3-Sat
   (C) Either of the above
   (D) None of the above

89. Hamiltonian path problem for undirected graphs is in P
   A) True
   B) False

90. Consider a binary string of length 11, and consider a schema 1*********1. Under crossover with uniform crossover site selection, calculate the lower limit on the probability of this schema surviving crossover.
   A) 1
   B) 0.5
   C) 0
   D) 0.2