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PET-2017 (Computer Applications– Faculty of Sciences)

Roll No: ..... Date..... 25 JUN 2017

Signature of the Candidate: .....

1. Consider the following nested representation of binary tree: (X Y Z) indicates Y and Z are the left and right subtrees, respectively, of node X. Note that Y and Z may be NULL , or further nested. Which of the following represents a valid binary tree?

   (a) (1 2 (4 5 6 7))

   (b) (1((234) 56)7)

   (c) (1(234)(567))

   (d) (1(23NULL)(45))

2. How many distinct binary search trees can be created out of 4 distinct keys?

   (a) 5 (b) 14 (c) 24 (d) 35

3. Which one of the following correctly determines the solution of the recurrence relation with T(1)= 1?

   $T(n) = 2T\left(\frac{n}{2}\right)$+log n

   (a) $\theta(n)$ (b) $\theta(n \log n)$ (c) $\theta(n^2)$ (d) $\theta(\log n)$

4. Let G be a weighted undirected graph and e be an edge with maximum weight in G Suppose there is a minimum weight spanning tree in G containing the edge e. Which of the following statements is always TRUE?

   (a) There exists a cutset in G having all edge of maximum weight.

   (b) There exists a cycle in G having all edges of maximum weight.

   (c) Edge e cannot be contained in a cycle.

   (d) All edges in G have the same weight.

5. For problem X and Y, Y is NP-complete and X reduces to Y polynomial time. Which of the following is TRUE?

   (a) If X can be solved in polynomial time, then so can Y

   (b) X is NP-complete

   (c) X is NP-hard

   (d) X is in NP , but not necessarily NP- complete

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6. Consider the grammar shown below.
   S→ CC, $C \rightarrow c\,C \mid d$
   The grammar is

   (a) LL(1)
   (b) SLR (1) but not LL (1)
   (c) LALR (1) but not SLR()1
   (d) LR (1) but not LALR(1)

7. Two shared resources and R_1 and R_2 are used by processes P_1 and P_2. Each process has a certain priority for accessing each resource. Let T_{ij} denote the priority of P_i for accessing R_j. A process P_i can santch a resource R_k from process P_j if T_{ik} is greater than T_{jk}. Given the following:
   (I) $T_{11} > T_{21}$
   (II) $T_{12} > T_{22}$
   (III) $T_{11} < T_{21}$
   (IV) $T_{12} < T_{22}$
   Which of the following conditions ensures that P_1 and P_2 can never deadlock?

   (a) (I) and (IV)
   (b) (II) and (III)
   (c) (I) and (II)
   (d) None of the above

8. Let the time taken to switch between user and kernel modes of execution be t_1 while the time taken to switch between two processes be t_2 . Which of the following is TRUE?

   (a) $t_1 > t_2$
   (b) $t_1 = t_2$
   (c) $t_1 < t_2$
   (d) Nothing can be said about the relation between t_1 and t_2

9. The principal of locality justifies the use of

   (a) Interrupts
   (b) DMA
   (c) Polling
   (d) Cache Memory

10. Consider a fully associative cache with 8 cache blocks (numbered 0-7) and the following sequence of memory block requests:
4, 3, 25, 8, 19, 6, 25, 8, 16, 35, 45, 22, 8, 3, 16, 25, 7
If LRU replacement policy is used, which cache block will have memory block 7?

(a) 4 (b) 5 (c) 6 (d) 7

11. The correct matching for the following pairs is
A. DMA I/O
B. Cache
C. Interrupt I/O
D. Condition Code Register
1. High speed RAM
2. Disk
3. Printer
4. ALU

(a) A-4 B-3 C-1 D-2
(b) A-2 B-1 C-3 D-4
(c) A-4 B-3 C-2 D-1
(d) A-2 B-3 C-4 D-1

12. R(A, B, C, D) is a relation. Which of the following does not have a lossless join, dependency preserving BCNF decomposition?

(a) $A \rightarrow B$, $B \rightarrow CD$
(b) $A \rightarrow B$, $B \rightarrow C$, $C \rightarrow D$
(c) $AB \rightarrow C$ $C \rightarrow AD$
(d) $A \rightarrow BCD$

13. The following functional dependencies hold for relation R(A, B, C) and S(B, D, E):
$B \rightarrow A$
$A \rightarrow C$
The relation R contains 200 tuples and the relation S contains 100 tuples. What is the maximum number of tuples possible in the natural join of R and S?

(a) 100
(b) 200
(c) 300
(d) 2000

14. What is the largest integer m such that every simple connected graph with n vertices and n edges contains at least m different spanning trees?

(a) 1 (b) 2 (c) 3 (d) n

15. An error correcting code has the following code word: 00000000, 00001111, 01010101, 10101010, 11110000. What is the maximum number of bit errors that can be corrected ?

(a) 0 (b) 1 (c) 2 (d) 3

16. Suppose the round trip propagation delay for a 10 Mbps Ethernet having 48-bit jamming signal is 46.4 us. The minimum frame size is:

(a) 94 (b) 416 (c) 464 (d) 512

17. Which of the following are used to generate a message digest by the network security protocols?

(P) RSA
(Q) SHA-1
(R) DES
(S) MD5

(a) P and R only
(b) Q and R only
(c) Q and S only
(d) R and S only

18. Consider the following pseudo –code:

```
IF ((A > B) AND (C > D)) THEN
        A = A+ 1
      B = B +1
ENDIF
```

The cyclomatic complexity of the pseudo-code is

(a) 2 (b) 3 (c) 4 (d) 5

19. In the Spiral model of software development, the primary determinant in selecting activities in each iteration is

(a) Iteration Size
(b) Cost
(c) Adopted process such as Rational or Extreme Programming
(d) Risk

20. Identify the correct order in which the following actions take place in an interaction between a web browser and a web server.
    1. The web browser requests a webpage using HTTP.
    2. The web browser establishes a TCP connection with web server.
    3. The web server sends the requested webpage using HTTP.
    4. The web browser resolves the domain name using DNS.

    (a) 4, 2, 1, 3
    (b) 1, 2, 3, 4
    (c) 4, 1, 2, 3
    (d) 2, 4, 1, 3

21. Which of the following languages are context-free?

    $L_1 = \{a^m b^n a^n b^m | m, n \geq 1\}$
    $L_2 = \{a^m b^n a^m b^n | m, n \geq 1\}$
    $L_3 = \{a^m b^n | m = 2n + 1\}$

    (a) L_1 and L_2 only
    (b) L_1 and L_3 only
    (c) L_2 and L_3 only
    (d) L_3 only

22. The language $\{0^n 1^n 2^n \ 1 \leq n \leq 10^6\}$ is

    (a) Regular
    (b) Context free but not regular
    (c) Context free but its complement is not context free.
    (d) Not context –free.

23. What can be said about regular language L over $\{a\}$ whose minimal finite state automation has two states?

    (a) Can be $\{a^n \mid n \text{ is not odd}\}$
    (b) Can be $\{a^n | n \text{ is not even}\}$
    (c) Can be $\{a^{n \geq 0}\}$
    (d) Either L can be $\{a^n \mid n \text{ is odd}\}$ or L can be $\{a^n | \ n \text{ is even}\}$

24. The language $L = \{ 0^i \ 2 \ 1^i \mid i \geq 0\}$ over the alphabet $\{0, 1, 2\}$ is

    (a) Not recursive
    (b) Is recursive and is a deterministic CFL
    (c) Is a regular language
    (d) Is not a deterministic CFL but a CFL.

25. The string 1101 does not belong to the set represented by 25 JUN 2017

(a) $L = 0^+$

(b) L is regular but not 0^+

(c) L is context free but not regular

(d) L is context free

26. Which of the following are regular sets?

1. $\{a^n b^{2m} \mid n \geq 0, m \geq 0\}$
2. $\{a^n b^m \mid n = 2m\}$
3. $\{a^n b^m \mid n \neq m\}$
4. $\{xcy \mid x, y \in \{a, b\}^*\}$

(a) 1 and 4 only

(b) 1 and 3 only

(c) 1 only

(d) 4 only

27. f(A, B) = A' + B. Simplified expression for function f(f(x + y, y), z) is

(a) x' +y

(b) xyz

(c) xy' + z

(d) None of these

28. The switching expression corresponding to
f(A,B,C,D) = $\sum$ = (1, 4, 5, 9, 11, 12) is

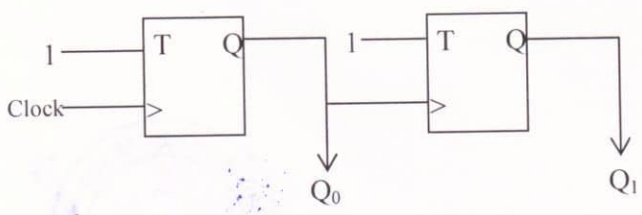
(a) BC'D' +A'C'D+AB'D

(b) ABC'+ACD+B'C'D

(c) ACD +A'BC' +AC'D'

(d) A'BD +ACD' +BCD'

29. In the sequential circuit shown below, if the initial value of the output Q_1 Q_0 is 00, what are the next four values of Q_1 Q_0?



(a) 11,10,01,00 (b) 10,11,01,00 (c) 10,00,01,11 (d) 11,10,00,01

30. A CPU generates 32-bit virtual addresses. The page size is 4KB. The processor has a translation look-aside buffer (TLB) which can hold a total of 128 page table entries and is 4-way set associative. The minimum size of the TLB tage is

(a) 11 bits
(b) 13 bits
(c) 15 bits
(d) 20 bits

31. Increasing the RAM of computer typically improves performance because

(a) Virtual memory increases
(b) Larger RAMs are faster
(c) Fewer page faults occur
(d) Fewer segmentation faults occur

32. A RAM chip has capacity of 1024 words of 8 bits each (1K × 8). The number of 2 × 4 decoders with enable line needed to construct a 16K × 16 RAM from 1K × 8 RAM is

(a) 4 (b) 5 (c) 6 (d) 7

33. The correct matching for the following pairs is

List –I
A. Activation record
B. Location counter
C. Reference counts
D. Address relocation

List-2
1. Linking loader
2. Garbage collection
3. Subroutine call
4. Assembler

(a) A - 3, B - 4, C - 1, D - 2
(b) A - 4, B - 3, C - 1, D - 2
(c) A - 4, B - 3, C - 2, D - 1
(d) A - 3, B - 4, C - 2, D - 1

34. The most appropriate matching for the following pairs

List- I

X. m = malloc (5); m = NULL;

Y. free (n); n--> value =5;

Z. char *p; *p='a;

List- II

1. Using dangling pointers
2. Using uninitialized pointers
3. Lost memory

(a) X - 1 Y - 3 Z - 2

(b) X - 2 Y - 1 Z - 3

(c) X - 3 Y - 2 Z - 1

(d) X - 3 Y- 1 Z - 2

35. What is the output of the following program?

```
#include<stdio.h>
int funcf (int x);
int funcg (int y);
main()
{
    int x = 5, y = 10, count;
   for(count =1;  count < = 2; ++count)
   {
    y += funcf(x) + funcg(x)
    printf("%d", y);
   }
          }
funcf(int x)
   {
   int y;
   y= funcg(g);
    return(y);
    }
funcg(int x)
   {
    static int y = 10;
    y += 1;
   return(y + x);
   }
```

(a) 43 80

(b) 42 74

(c) 33 37

(d) 32 32

36. Which of the following is TRUE?

(a) Every relation in 3NF is also in BCNF

(b) A relation R is in 3NF if every non-prime attribute of R is fully functionally dependent on every key of R

(c) Every relation in BCNF is also in 3NF

(d) No relation can be in both BCNF and 3NF

37. Consider a complete binary tree where the left and right subtrees of the root are max-heaps. the lower bound for the number of operations to convert the tree to a heap is

(a) $\Omega(\log n)$

(b) $\Omega(n)$

(c) $\Omega(n \log n)$

(d) $\Omega(n^2)$

38. Using a 4-bit 2's complement arithmetic, which of the following additions will result in an overflow?

(i) 1100 + 1100

(ii) 0011 + 0111

(iii) 1111 + 0111

(a) (i) only

(b) (ii) only

(c) (iii) only

(d) (i) and (iii) only

39. A friend function can be used to

(a) Avoid arguments between classes

(b) Allow access to classes whose source code is unavailable

(c) Allow one class to access an unrelated class

(d) Increase the versatility of an overloaded operator

40. **A regression test:**

(a) Will always be automated

(b) Will help ensure unchanged areas of the software have not been affected

(c) Will help ensure changed areas of the software have not been affected

(d) Can only be run during user acceptance testing