2012 Academic Challenge

COMPUTER SCIENCE TEST - STATE FINAL

This Test Consists of 30 Questions

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GENERAL DIRECTIONS

Please read the following instructions carefully. This is a timed test; any instructions from the test supervisor should be followed promptly.

The test supervisor will give instructions for filling in any necessary information on the answer sheet. Most Academic Challenge sites will ask you to indicate your answer to each question by marking an oval that corresponds to the correct answer for that question. Only one oval should be marked to answer each question. Multiple ovals will automatically be graded an incorrect answers.

Be sure ovals are marked as ● , not ⊙ , ◐ , ◑ , etc.

If you wish to change an answer, erase your first mark completely before marking your new choice.

You are advised to use your time effectively and to work as rapidly as you can without losing accuracy. Do not waste your time on questions that seem too difficult for you. Go on to the other questions, and then come back to the difficult ones later if time remains.

*** TIME: 40 MINUTES ***

DO NOT OPEN TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO!

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1. The aspect ratio of a flat screen monitor is determined by which of the following?

   a) It is the number of pixels compared to the viewing angle.
   b) It is the width of the display area compared to its height.
   c) It is the number of colors compared to the number of pixels.
   d) It is the viewing angle compared to the height of the display area.
   e) It is the diagonal viewing size compared to the pixel pitch.

2. A primary key in a relational database table has which property?

   a) It uniquely identifies the table.
   b) It is normally limited to only one record within the table.
   c) It uniquely identifies a row within the table.
   d) It is usually null.
   e) None of the above.

3. Which of the following best describes geotagging?

   a) It is the ability to post pictures to Facebook from anywhere in the world.
   b) It was the software used to help decode the human genome and tag each gene.
   c) It is a treasure hunting game where participants use a GPS to hide and seek containers.
   d) It is a feature in a cell phone that allows the phone to be located automatically.
   e) It involves the addition of geographical metadata to a file.

4. Dijkstra's algorithm is which of the following?

   a) It is an advanced algorithm for searching binary trees.
   b) It is an algorithm used in a network routing protocol to determine the shortest path between two nodes.
   c) It is an algorithm to efficiently parse strings for errors.
   d) It is a method used to convert stacks to queues.
   e) None of the above.

5. What is the equivalent decimal value for the 8 bit biased base 2 number 10010101, if the bias is $-(2^7-1)$?

   a) 149   b) -149   c) 22   d) -21   e) 21

6. Determine the minimal sum of products function for the Karnaugh map to the right.

   a) (AB') or (AB) or (A'C)
   b) (AC') or (B'C) or (A'BC)
   c) (AB') or (A'C) or (AC')
   d) (A'C) or (AC') or (AB'C)
   e) (AB') or (AC') or (AB)

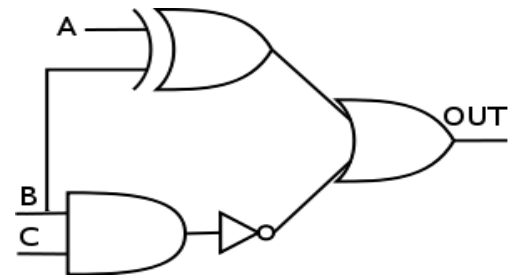|	A'B'	A'B	AB	AB'
C'D'	F	F	T	T
C'D	F	F	T	T
CD	T	T	F	T
CD'	T	T	F	T

7. Convert the floating point hexadecimal number A7.4 to decimal.

    a) 10100111.01   b) 107.4   c) 2676   d) 267.6   e) 167.25

8. What is the value of the output OUT for the following logical circuit when B is TRUE?

    a) TRUE
    b) FALSE
    c) A XOR C
    d) A OR C'
    e) (AC)'

9. Which of the following represents the adjacency matrix for the given graph? The verticies will be listed in A, B, C, D, E order.
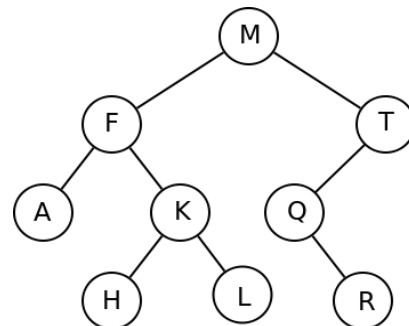
    a) $\begin{bmatrix} 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 \end{bmatrix}$

    b) $\begin{bmatrix} 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 \end{bmatrix}$

    c) $\begin{bmatrix} 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 \end{bmatrix}$

    d) $\begin{bmatrix} 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 \end{bmatrix}$
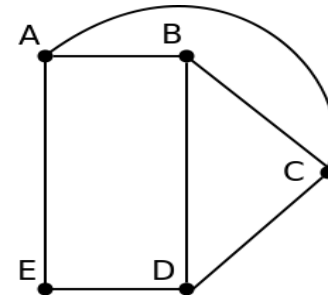
    e) None of the above.

10. For a post-order traversal of the following tree, in what order are the nodes visited?

    a) AFHKLMQRT
    b) MFAKHLTQR
    c) TRQMLKHFA
    d) AHLKFRQTM
    e) HLRAKQFTM

11. An algorithm takes (300n – n^2 + nlog$_2$n) steps. This algorithm is said to be Big-Oh of what?

    a) O(n^2)   b) O(300n)   c) O(nlog$_2$n)   d) O(n)   e) O(300n + nlog$_2$n)

12. Which of the following is **not** true regarding a queue data structure.

    a) Items enqueued are put at the end of the queue.
    b) Items dequeued are taken off of the front of the queue.
    c) Queues can be implemented using linked lists or arrays.
    d) A queue is often referred to as a First In, First Out structure.
    e) Items may be found and removed from any portion of the queue.

```
// *****  Code used on problems 13, 14 and 15  *****//
int func(int m, int n) {
   if ((m % n) == 0)
      return n;
   else
      return func(n, m % n);
}
```

13. Which of the following is true regarding this recursive function?

    a) The base case for this function returns n when n divides m without a remainder.
    b) The base case will return 0 or 1.
    c) The base case will call the func with arguments n and m%n.
    d) The base case for this function will return an even number.
    e) The base case for this function may never get called.

14. How many times is func executed while completing the following function call?   func(240, 33);

    a) 4   b) 2   c) 250   d) 20   e) The function endlessly calls itself.

15. Which statement best describes the purpose of the function?

    a) This function returns the larger of the two numbers.
    b) This function returns the greatest common divisor of the two numbers.
    c) This function returns the smaller of the two numbers.
    d) This function returns the average of the two numbers.
    e) This function returns the modulo division of the first number by the second.

```
// *****  Code used on problems 16, 17 & 18  *****//
int calcLengthLoan(double prin, double rate, double &totPaid, double payment) {
   int months = 0;
   double loanValue = prin;

   if (prin*rate/12 >= payment) {
      months = -1;              // can never repay loan

   } else {
      totPaid = 0;
      while (loanValue*(1+rate/12) > payment) {
         totPaid += payment;
         loanValue = loanValue*(1+rate/12) - payment;
         months++;
      }
      // amount left is less than payment
      if (loanValue > 0) {
         totPaid += loanValue*(1+rate/12);
         months++;
      }
   }
   return months;
}
```

16. What is returned by the following function call?   calcLengthLoan(1000, 0.12, total, 500);

    a) 1015.25   b) 500   c) 2   d) 3   e) -1

17. Which of the following describes the method of passing arguments for the function?

    a) `prin, rate, totPaid, payment` are passed by value.
    b) `prin, rate, totPaid, payment` are passed by reference.
    c) `prin, rate, totPaid, payment, months` are passed by value.
    d) `prin, rate, payment, months` are passed by value and `totPaid` by reference.
    e) `prin, rate, payment` are passed by value and `totPaid` by reference.

18. What is returned by the following function call?   `calcLengthLoan(1000, 0.12, total, 5);`

    a) 1015.25   b) 500   c) 2   d) 3   e) -1

```
// *****  Code used on problems 19 & 20  *****//
1 > int i, m = 1;
2 > for (i=0;i<4;i++) {
3 >    m = m << i;
4 >    cout << m << endl;
5 > }
```

19. What type of operator is the `<<` used on line 3?

    a) conditional   b) bitwise   c) cast   d) modulus   e) output

20. What will the value of m be on the last line of output?

    a) 5   b) 16   c) 32   d) 64   e) 128

```
// *****  Code used on problems 21, 22, & 23  *****//
1  > int my_func(int a, int b, int c) {
2  >    int i;
3  >    if (a > b && b > c)
4  >       i = a;
5  >    else if (a > b && b < c)
6  >       i = b;
7  >    else
8  >       i = c;
9  >    return i;
10 > }
11 > int main() {
12 >    int i, j;
13 >    int my_array[] = {20, 5, 38, 19, 4, 53, 67, 4, 18};
14 >    for (i=0;i<6;i++)
15 >       j = my_func(my_array[i], my_array[i+1], my_array[i+2]);
16 >    cout << j;
17 >    return 0;
18 > }
```

21. What is the `&&` operator used on lines 3 and 5?

    a) Bitwise AND   b) Logical OR   c) Bitwise OR   d) Logical AND   e) Logical XOR

22. How many times is line 4 executed?

    a) 0   b) 1   c) 2   d) 3   e) 4

23. What will be the value of `j` on line 16?

    a) 4   b) 19   c) 38   d) 5   e) 18

```
// *****  Code used on problems 24, 25, 26 and 27  *****//
1 > class person {
2 >    private:
3 >        string name;
4 >        int age;
5 >    public:
6 >        person()                { name="DEFAULT NAME"; age=20; };
7 >        void setAge (int a)    { age = (a<0) ? 1: a; };
8 >        void setName(string s) { name = s; };
9 >        int  getAge ()   const { return age; };
10>        string getName() const { return name; };
11>        bool operator>  (const person &right) const {
12>           return (name>right.name || name == right.name && age > right.age);
13>        };
14>        person operator++(int);
15> }; // end of person class
16>
17> person person::operator++(int) {
18>    person temp = *this;
19>    age++;
20>    return temp;
21> }  // end ++ operator
22>
23> class student : protected person {
24>    private:
25>        string major;
26>    public:
27>        student()                     { major = "UNDECIDED"; };
28>        string getMajor() const   { return major; };
29>        void    setMajor(string s) { major = s; };
30> }; // end class student
```

24. Which of the following is true regarding the `person` and `student` classes?

    a) `student` is the base class for `person`.
    b) `student` is the derived class of `person`.
    c) `student` Has-A `person`.
    d) `person` Is-A `student`.
    e) None of the above.

```
// Use the following declarations for 25, 26 and 27
person p[2];
student s;
```

25. How many times is a `student` or `person` constructor called by the code?

    a) 2   b) 3   c) 4   d) 5   e) 6

26. Which of the following statements will not generate a syntax error during compilation?

    a) `cout << person.getAge();`
    b) `p[0].setAge(19);`
    c) `cout << s.getAge();`
    d) `cout << p[1].name;`
    e) All of the above will generate a compiler error.

27. What is printed by the following statement?
    `cout << p[1].getName() << s.getMajor();`

    a) This will cause a compiler error.
    b) This will cause a runtime error.
    c) `DEFAULT UNDECIDED`
    d) `DEFAULT NAMEUNDECIDED`
    e) Can not determine from the information provided.

```
// *****  Code used on problems 28, 29, & 30  *****//
1  > float my_func1(int a) {
2  >     return float(a*a);
3  > }
4  > float my_func2(int a) {
5  >     float i;
6  >     i = 2.0*a;
7  >     return i;
8  > }
9  > int main() {
10 >     int i;
11 >     float j = 0.0;
12 >     for (i=0;i<6;i++) {
13 >         if (i % 2) {
14 >             j += my_func1(i);
15 >         } else {
16 >             j += my_func2(i);
17 >         }
18 >     }
19 >     cout << j << endl;
20 >     return 0;
21 > }
```

28. On line 2 above, what is the purpose of float?

    a) It explicitly type casts an integer to a float.
    b) It declares a variable of type float.
    c) It will truncate the least significant digits.
    d) It converts the integer variable `a` to a float variable.
    e) It ensures that the value of a*a will never be greater than the value passed to my_func1.

29. When will `my_func1()` be called?

    a) Every iteration of the for loop.
    b) When `i` is greater than 6.
    c) When `i` is odd.
    d) When `i` is even.
    e) It will never be called.

30. What is the value of `j` when it is output?

    a) 109   b) 59   c) 22   d) 47   e) 108