2013 Academic Challenge

COMPUTER SCIENCE TEST - REGIONAL

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. Requirements for an information system are normally generated in which phase of the system's development lifecycle?

    a. Design
    b. Analysis
    c. Construction
    d. Testing
    e. Implementation

2. Which of the following is a popular operating system for mobile devices?

    a. Android   b. DOS   c. UNIX   d. MacOS   e. Java

```
// *** Use the following code for Questions 3, 4, and 5 *** //
 1       int value[5] = { 1, 2, 3, 4, 5 };
 2       int bigvalue = 50;
 3       for(int i=0; i<5; i++) {
 4          cout << value[i] << endl;
 5          if (i%2 == 1)
 6              bigvalue *= value[i];
 7          else
 8              bigvalue += i;
 9          cout << bigvalue << endl;
10       }
```

3. How many times will line 6 be executed?

    a. Zero   b. 5   c. 2   d. 3   e. 4

4. What will be output on the last iteration of the for loop?

    a. 4   b. 4   c. 5   d. 5   e. 5
        65   412   65   408   412

5. Which of the following lists all of the assignment operators used in the above code?

    a. = += *=   b. *= +=   c. =   d. = ==   e. = == += *=

6. Which of the following statements is true of UNICODE?

    a. Provides a unique number for every character, regardless of platform, program, or language.
    b. Is used in XML and LDAP.
    c. Offers significant cost savings over legacy character sets.
    d. Allows data to be transported through many different systems without corruption.
    e. All of the above.

7. Which of the following terms is not commonly used to describe how information is stored on a hard disk?

    a. Platter   b. Cylinder   c. Track   d. Album   e. Sector

8. What is the following binary number, 10101101, when converted to decimal?

    a. AD   b. 155   c. 173   d. 10101101   e. None of the above

9. What is the following hexadecimal number, 193, converted to binary?

    a. 11000001
    b. C1
    c. 110101011
    d. 110010011
    e. None of the above.

10. How many rows will a truth table with four input variables (F(a,b,c,d)) contain?

    a. 2   b. 3   c. 8   d. 16   e. 256

11. What is the Boolean expression that matches the given truth table?

A	B	C	OUTPUT
F	F	F	F
F	F	T	F
F	T	F	T
F	T	T	F
T	F	F	T
T	F	T	T
T	T	F	T
T	T	T	T

    a. A or (BC')
    b. A or (A'C')
    c. A and (A'BC')
    d. A' or B'
    e. (A'BC')'

12. Which of the following is not true regarding a linked list data structure?

    a. Linked lists may grow and shrink as the program is running.
    b. Binary searches may be implemented when finding data in a linked list.
    c. Linked lists use pointers/references within each node to point to the next node.
    d. Inserting items into a linked list is generally easier than inserting items into an array.
    e. Nodes in a linked list take up more memory than nodes in an array that would store an equivalent amount of data.

13. Which of the following is true regarding linear and binary searches?

    a. Binary searches are given their name because they are used to search binary numbers.
    b. Linear searches are not possible with sorted data.
    c. Binary searches are not possible with unsorted data.
    d. Binary searches of 100 items require at most 50 comparisons.
    e. Linear searches of 100 items require at most 50 comparisons.

```
// *** Use the following code for Questions 14 and 15 *** //
1      class Ball {
2         public:
3             Ball(float=1);
4             float bounce(float) const;
5             float getRadius() const  { return radius; }
6             float setRadius(float r) { radius = (r>0) ? r : 1; }
7         private:
8         float radius;
9      };
10
11     Ball::Ball(float r) {
12        setRadius(r);
13     }  // end Ball constructor
14
15     float Ball::bounce(float height) {
16        float newheight = 0;
17        if (height > 0)
18           newheight = height * 0.75;  // bounces 3 fourths of the height
19        return newheight;
20     } // end bounce method
```

14. What is displayed after the following code has been executed?

```
Ball b(5), c;
cout << b.bounce(12) << " " << c.getRadius();
```

  a. 9 1   b. 12 0   c. 12 1   d. 5 1   e. None of the above.

15. Which of the functions from the class header are inline?

  a. Constructor, getRadius, setRadius, bounce
  b. getRadius, bounce
  c. getRadius, setRadius, bounce
  d. getRadius, setRadius
  e. None of the methods are inline.

16. What is the value of the following expression when X is 5, Y is 30, and Z is 50 when implemented as code?

```
(X >= Y) || (Y != Z && Z <50)
```

  a. Not enough information given
  b. Runtime error
  c. Syntax error
  d. TRUE
  e. FALSE

17. If the ENQUEUE(p) command places the item "p" in the queue and the DEQUEUE() command removes an item, what would the queue look like after the following commands if the queue was empty to begin?

```
ENQUEUE(A); ENQUEUE(Z); ENQUEUE(Q); DEQUEUE(); ENQUEUE(B); ENQUEUE(R); DEDQUEUE();
```

  a. QBR   b. AZQBR   c. AZB   d. BZA   e. RBQZA

```
// *** Use the following code for Questions 18, 19, 20, 21, and 22 *** //
1      void add (int a, int b) {
2         static int i = 0;
3         i++;
4         cout << i << ":   " << a << " + " << b << " = " << a + b << endl;
5      } // end add
6      int multiply(int a, int b) {
7         int c = a * b;
8         return c;
9      } // end multiply
10     int divide (int a, int b, int &mod) {
11        mod = a%b;
12        return a/mod;
13     }
```

18. Which of the functions listed above are value returning?

   a. All of them   b. None of them   c. add   d. add & multiply   e. multiply & divide

19. Which of the functions listed above use an argument that is passed by reference?

   a. All of them   b. None of them   c. add   d. multiply   e. divide

20. Using the variables declared below, which of the following lines of code will produce an error?
```
int i = 5, j = 2, k = 7;
```

   a. `add(5, j);`
   b. `cout << multiply(4, 4);`
   c. `divide(i, j, k);`
   d. `cout << add(i, j);`
   e. All of the function calls are legal.

21. Trace the following code and determine what it displays to the screen.
```
for (int i=1; i<4; i++)
   add(i, multiply(i,i));
```

   a. `1: 1 + 1 = 2`   b. `1 + 1 = 2`   c. `1: 1 + 1 = 2`
       `2: 2 + 2 = 4`   `2 + 4 = 6`   `1: 2 + 4 = 6`
       `3: 3 + 3 = 6`   `3 + 9 = 12`   `1: 3 + 4 = 12`

   d. `1: 1 + 1 = 2`   e. The code has errors
       `2: 2 + 4 = 6`   and will not compile.
       `3: 3 + 9 = 12`

22. Trace the following code and determine what it displays to the screen.
```
int k;
for (int i=2; i<11; i+=4)
   cout << i << ":   " << divide(i,i+3,k) << endl;
```

	a.	b.	c.	d.	e.
	2: 0	0: 1	2: 1	0: 8	2: 2
	6: 4	4: 1	6: 1	4: 4	6: 4
	10: 8	8: 1	10: 1	8: 0	10: 8

```
// *** Use the following code for Questions 23, 24, and 25 *** //
1       int value[2][5] = {{1, 2, 3, 4, 5 },{11,12,13,14,15}};
2       int final = 0;
3       for(int i=0; i<4; i++) {
4          if (value [0][i] < 3)
5             final += value[0][i] + value[1][i];
6          else
7             final *= value[0][i] + value[1][i];
8          cout << final << endl;
9       }
```

23. How many elements in the value array will be used to determine the value of final?

   a. 5   b. 2   c. 8   d. 7   e. 14

24. What is the last number to be output?

   a. 149,760   b. 7488   c. 4   d. 416   e. 18

25. What is the purpose of endl on line 8?

   a. Signifies to the C++ compiler that the end of an executable statement as been reached
   b. Writes a newline character to the standard output stream
   c. Resets the value of `final` to zero
   d. Instructs the C++ compiler to skip the next iteration in the for loop
   e. Halts the execution of the program

```
// *** Use the following code for Questions 26, 27, 28, 29, and 30 *** //
1       int my_numb [10] = {8, 9, 7, 14, 28, 99, 5, 3, 14, 1};
2       int t;
3       for (int j=0;j<9;j++) {
4          for (int i=1;i<10-j;i++) {
5             if (my_numb [i-1] > my_numb [i]) {
6                t = my_numb[i-1];
7                my_numb [i-1] = my_numb [i];
8                my_numb [i] = t;
9             }
10         }
11      }
```

26. What will `my_numb` contain when the program is finished?

   a. {1, 3, 5, 7, 8, 9, 14, 14, 28, 99}
   b. {8, 9, 7, 14, 28, 99, 5, 3, 14, 1}
   c. {1, 3, 5, 7, 8, 9, 14, 28, 99}
   d. {7, 5, 3, 8, 1, 9, 14, 14, 28, 99}
   e. {99, 28, 14, 14, 9, 8, 7, 5, 3, 1}

27. As numbers are moved about in the array during execution, how many different numbers will my_numb [9] hold before the array is in its final state?

    a. 4   b. 3   c. 8   d. 5   e. 2

28. When line 11 is reached and $j = 5$, what is the value of my_numb [5]?

    a. 8   b. 5   c. 9   d. 1   e. 7

29. What is the largest index that should be used for array my_numb?

    a. 10   b. 9   c. 99   d. 1   e. The largest integer for the compiler

30. When $j = 2$, how many times will line 6 be executed?

    a. 0   b. 4   c. 3   d. 7   e. 2