Worldwide Youth in Science and Engineering

2014 Academic Challenge

COMPUTER SCIENCE TEST - SECTIONAL

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!

1. Open source refers to which of the following?

    a. Providing the executable program to the user of the program.
    b. Allowing people to purchase software in an open manner.
    c. Allow the original purchaser of software to sell it to someone else.
    d. Providing the executable program to anyone who wishes to purchase it.
    e. Providing the source code for the program to anyone who wishes to view it for free.

2. A hard disk uses magnetic charges to represent 1s and 0s on its surface. How are the 1s and 0s represented on an optical disc?

    a. With a magnetic charge, just like a hard disk.
    b. By changing the acoustic characteristics of the optical disc.
    c. A laser beam alters the surface of the disc, with the resulting flat areas called lands and the bumpy areas called pits.
    d. With tracks and sectors; a track is used for a 1 and a sector is used for a 0.
    e. None of the above.

3. Which one of the following types of storage is volatile?

    a. Hard disk   b. RAM   c. Optical disc   d. Thumb drive   e. SD card

4. Which of the following wireless connections has the shortest range?

    a. WiMax   b. Satellite   c. Microwave   d. Wi-Fi   e. Bluetooth

5. Which of the answers is equivalent to the following Boolean expression?
!((x>y) && (y != z))

    a. (x<=y) || (y==z)
    b. (x<y) && (y==z)
    c. (x<=y) && (y==z)
    d. (x>y) || (y!=z)
    e. None are equivalent.

6. What is the value of the following logic circuit?
    a. TRUE
    b. FALSE
    c. B and (C or A)
    d. (A'B) or (CA) or (AB)
    e. None of the above.
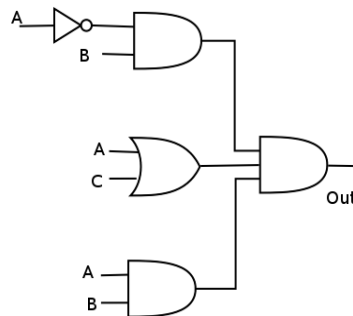
Use the following code for Questions 7, 8, & 9.

```
1     class Rectangle {
2        public:
3              Rectangle(float=1, float=1);
4              float getLength()    const  { return length;          }
5              float getWidth ()    const  { return width;           }
6              float getPerminter() const  { return 2*width+2*length; }
7              float getArea()      const  { return width*length;    }
8              bool  setWidth (float);
9              bool  setLength(float);
10        protected:
11            float length, width;
12     };
13
14     Rectangle::Rectangle(float l, float w) {
15        setLength(l);
16        setWidth(w);
17     } // end Rectangle constructor
18
19     bool Rectangle::setLength(float l) {
20        length = (l > 0) ? l : 2;
21        return (l > 0);  // if l was valid, return true
22     } // end setLength method
23
24     bool Rectangle::setWidth(float w) {
25        width = (w > 0) ? w : 2;
26        return (w > 0);  // if w was valid, return true
27     } // end setWidth method
```

7. Classifying the `width` and `length` as protected is an example of what?

    a. abstraction   b. initialization   c. inheritance   d. encapsulation   e. polymorphism

8. For the following instantiated rectangles, what is printed?

    ```
    Rectangle a, b(2, -3), c[3];
    cout << b.getPerimeter() << " " << a.getWidth();
    ```

    a. -2 1   b. 12 2   c. 4 2   d. 8 2   e. 8 1

9. For the following instantiated rectangles, what is printed?

    ```
    Rectangle a, b(2, -3), c[3];
    cout << c[1].getPerimeter() << " " << a.width;
    ```

    a. Nothing, the statement results in a compiler error.
    b. Nothing, the statement results in a runtime error.
    c. 1 1
    d. Cannot be determined from the information provided.
   e. 4 1

Use the following code for Questions 10, 11, & 12.

```
1   int *xx;
2
3   xx = new int;
4   if (xx == NULL)
5      exit(1);
6   *xx = 55;
7   cout << *xx << endl;
8   delete xx;
```

10. What will be output to standard output?

    a. 55
    b. NULL
    c. Whatever value is in relative memory address 55.
    d. Whatever value is in physical memory address 55.
    e. None of the above.

11. When will line 5 be executed?

    a. When xx equals 55.
    b. When only old int variables are available.
    c. It will never be executed as xx will always contain a value.
    d. When the user inputs 1.
    e. When sufficient space was not available to be allocated for an int.

12. What is the purpose of line 8?

    a. Set *xx to zero.
    b. Erase whatever was written to standard output.
    c. Deallocate the space used by *xx.
    d. Initialize the value of xx to zero.
    e. None of the above.

13. What is the post-order traversal of the tree to the right?

    a. ADFHIKLM
    b. HDAFKIML
    c. HDKAFIML
    d. AFDILMKH
    e. LAFIMDKH
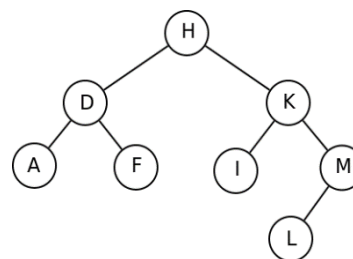
Use the following code for Questions 14, 15, & 16.

```
1   int myfunc(const int& x)
2   {
3       return x+10;
4   }
5   int main(void)
6   {
7       const int x=3;
8       int y=6;
9       int z=0;
10
11      z = myfunc(x);
12      cout << z << endl;
13
14      z = myfunc(y);
15      cout << z << endl;
16
17      cout << endl;
18      return 0;
19  }
```

14. What does the & signify on line 1?

   a. The ampersand is a comment.
   b. That the function can be called when the value of the parameter is positive.
   c. That the parameter is passed by pointer.
   d. That the parameter is passed by value.
   e. That the parameter is passed by reference.

15. What will be output to standard output?

   a. 13   b. 13   c. 3   d. 16   e. None of the
      16   13   6   16   above.

16. If the following statement was placed on line 10, what would the output be?
`x += 10;`

   a. 23   b. 10   c. 20   d. 10   e. None of the
      16   13   16   6   above.

17. For the graph to the right, determine the first row of the adjacency matrix.
    Assume that the position of the nodes in the adjacency matrix will be A
    first, B second, etc... So the first row relates to how A can reach the other
    nodes.

   a. 0 1 1 1 1 1
   b. 1 1 1 1 1 1
   c. 0 0 0 0 0 0
   d. 1 1 0 1 1 1
   e. 1 1 1 1 1 0
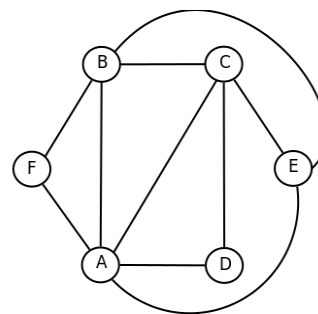
Use the following code for Questions 18, 19, & 20.

```
1  int main()
2  {
3     const int max=4;
4
5     for(long i = long(0), j = long(1) ; i <= max ; i++, j += j)
6        cout << i << "  " << j << endl;
7
8     return 0;
9  }
```

18. On line 5, what is the purpose of `long` before the `0` and `1`?

    a. It allows a character to be stored in the variables.
    b. It casts the integer literal to long, the same type as the variables.
    c. It indicates that the value should be stored in the lower byte of the word.
    d. It is needed because there are two initialization expressions in the for loop.
    e. None of the above.

19. How many times will the `for` loop execute?

    a. 0
    b. 4
    c. 5
    d. 6
    e. Unable to determine with the information given.

20. What will the value of `j` be the last time that line 6 is executed?

    a. 5   b. 32   c. 4   d. 16   e. 0

21. Convert the following 8 bit 2's complement number (01010101) to decimal.

    a. 1010101   b. 111   c. -111   d. 85   e. -85

22. Use the pop and push operations of a stack with the following commands to determine the contents of the stack when the operations are complete. Assume the stack is empty before the first command.

    ```
    push(A); push(B); pop(); push(C); push(D); push(E); pop(); push(A); push(G); pop();
    ```

    a. ACDA   b. ABCDEAG   c. ABCDEG   d. DEAG   e. BCDA

23. What is the maximum value of a 16 bit, signed integer that uses one bit for the sign?

    a. 2^{16} b. 2^{15} c. $2^{16} - 1$ d. $2^{15} - 1$ e. No maximum exists.

Use the following code for Questions 24 & 25.

```
1   const int max=4;
2   int i;
3   int j=0;
4
5   for(i = 0; i <= max ; i+=j) {
6      if (j=1)
7          j++;
8      cout << i << "  " << j << endl;
9   }
```

24. How many times will the `for` loop execute?

   a. 0   b. 3   c. 4   d. 5   e. 8

25. What will the value of `j` be on the last iteration of the loop?

   a. 1   b. 2   c. 8   d. 4   e. 5

Use the following code for Questions 26 & 27.

```
1   int main()
2   {
3      char letter = 0;
4
5      cout << endl << "Enter a letter: ";
6      cin >> letter;
7
8      if ((letter >= 'A') && (letter <= 'Z'))
9          letter += 'a' - 'A';
10     cout << endl << letter;
11
12     return 0;
13  }
```

26. For a user input of R, what will be output to standard output?

   a. A   b. a   c. R   d. r   e. None of the above.

27. What is the `&&` on line 8?

   a. Logical AND operator
   b. Logical OR operator
   c. Double addition operator
   d. Logical negation operator
   e. Concatenation operator

Use the following code for Questions 28 & 29.

```
1      int myfunc(int xx[][3],int yy) {
2         int zz = 0;
3         for (int i = 0; i < yy; i++)
4            for (int j = 0; j < 3; j++)
5               if (xx[i][j]%2)
6                  zz++;
7         return zz;
8      }
9      int main()
10     {
11        int x [3][3] = { { 4, 5, 9 },
12                         { 4, 8, 22 },
13                         { 3, 45, 2 } };
14        int y,z;
15        y = (sizeof x)/(sizeof x[0]);
16        z = myfunc(x,y);
17        cout << z << endl;
18        return 0;
19  }
```

28. What will be output to standard output?

    a. 0   b. 4   c. 5   d. 9   e. 18

29. What is the value of y after line 15 executes?

    a. 0
    b. 2
    c. 3
    d. 5
    e. Unable to determine with the information given.

30. Which of the following best describes the try/catch construct?

    a. This is a compiler directive used to find syntax errors.
    b. This is code used to attempt to link libraries and catch linking errors that occur.
    c. Code to detect possible runtime errors, trap them and provide code to handle them.
    d. Answers a, b, and c are all correct.
    e. Neither a, b, nor c are correct.