Worldwide Youth in Science and Engineering

2015 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 as an incorrect answer.

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!

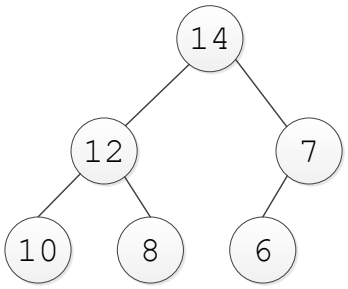
WYSE – Academic Challenge
Computer Science– 2015

1. Rank the following functions with the slowest growing functions listed first and the fastest growing coming last.

   I n^2 II $n!$ III $\log_2 n$ IV n V 2^n

   a. III,IV,I,V,II b. IV,III,I,V,II c. I,II,III,IV,V d. IV,III,I,V,II e. III,IV,V,I,II

2. Using the tree to the right, list the order in which the nodes would be visited using preorder traversal.



   a. 10, 12, 8, 14, 7, 6
   b. 10, 8, 12, 6, 7, 14
   c. 14, 12, 10, 8, 7, 6
   d. 14, 12, 7, 10, 8, 6
   e. None of the above.

3. The following equation is in infix notation. Write the equation in postfix notation.

```
A/B-C+D*E-A*C
```

   a. AB/C-DE*+AC*-
   b. AB/C-DE*+AC-*
   c. AB/C-DE+*AC*-
   d. AB-/C-DE*+AC*
   e. None of the above.

4. A circular queue can easily be implemented within an array. One problem with this implementation is that the array can become full. A common method to overcome this is to double the size of the array when it does become full. In addition, the pointer to the front of the queue actually points to the array element before the first entry in the queue. This array element will never contain a value associated with the queue. The pointer to the rear of the queue always points to the last element in the queue. If ((Rear + 1) % sizeof(array)) == Front, then the array is full and it will need to be doubled in size before another value can be added to the queue. Items at the left side of the array will remain in place, and items on the right side of the array will be on the far right side of the expanded array.

   Given the below array that implements a circular queue as described above, what will the Front and Rear pointers be after the following transactions?

```
enqueue E
enqueue F
dequeue
```

[0]	[1]	[2]	[3]	[4]	[5]
C	D			A	B

Front = 3 Rear = 1

   a. Front = 5, Rear = 3
   b. Front = 10, Rear = 3
   c. Front = 3, Rear = 10
   d. Front = 3, Rear = 5
   e. None of the above.

5. What is the hexadecimal number A7 converted to binary?

   a. 10100111 b. 167 c. 10010111 d. 11100101 e. None of the above.

6. Which of the following Boolean expressions is equivalent to (A and B)' ?

   a. A' and B' b. A or B c. A' or B' d. A and B e. A xor B

7. Biased numbers are used to represent the exponent on floating point numbers. The bias of an n bit number is given by $2^{(n-1)} - 1$ and is then subtracted from the original number. Using this, determine the decimal value of the 8 bit biased number, 10110110.

   a. B6 b. 182 c. 55 d. 54 e. 256

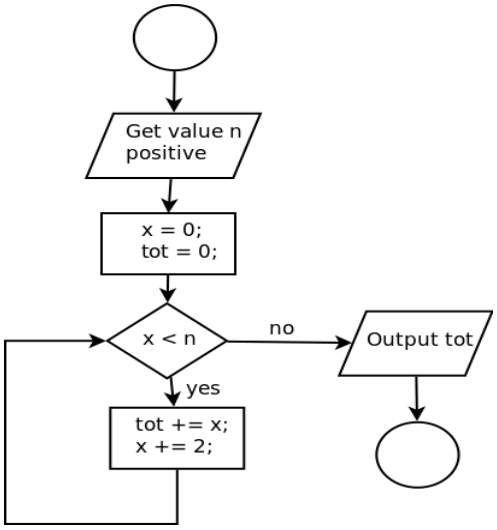
8. What is the equivalent logical value of the Boolean expression if A is True and B is false?

   ```
   (AB') xor (BC)
   ```

   a. True b. False c. C d. C' e. None of the above.

9. What best describes the algorithm illustrated by the flow chart to the right?

   a. Adds all non-negative numbers less than or equal to n.
   b. Adds all non-negative even numbers less than or equal to n.
   c. Adds all non-negative odd numbers less than or equal to n.
   d. Adds all non-negative even numbers less than n.
   e. Adds all non-negative odd numbers less than n.



10. Rank from slowest to fastest the various types of system memory.

    a. tape, hard drive, cache, RAM, registers
    b. hard drive, tape, registers, RAM, cache
    c. registers, tape, RAM, cache, hard drive
    d. cache, hard drive, tape, registers, RAM
    e. tape, hard drive, RAM, cache, registers

11. Bandwidth can best be described as which of the following?

    a. The time it takes for a bit to travel across a network.
    b. The rate at which bits are sent over a network.
    c. The frequency range or band of frequencies used in wireless connections.
    d. The time required to initiate a connection.
    e. None of the above.

12. Which is best description of how HTML relates to HTTP?

    a. They are two acronyms that may be used interchangeably.
    b. They have no relation to one another.
    c. HTML describes how web pages are transferred and HTTP relates how they are displayed.
    d. HTTP describes how fast web pages are displayed in the browser and HTML describes how quickly the pages are transferred from the server.
    e. HTTP describes how web pages are transferred and HTML relates how they are displayed.

Use the following code for questions 13, 14, & 15.

```
1       /********************** POINT ************************/
2       class Point {
3          public:
4             Point( int = 1, int = 1 ); // default constructor
5             void setX (int xVal) { x = xVal; };     // set x in coordinate pair
6             void setY (int yVal) { y = yVal; };     // set y in coordinate pair
7             int  getY () const { return y; };
8             int  getX () const { return x; };
9             string getName() const { return "Point"; };
10            void print() const;                     // output Point object
11         private:
12            int x;  // x part of coordinate pair
13            int y;  // y part of coordinate pair
14      }; // end class Point
15
16      Point::Point( int xValue, int yValue ) {
17         setX(xValue);
18         setY(yValue);
19      }
20
21      void Point::print() const {
22         cout << '[' << getX() << ", " << getY() << ']';
23      } // end function print
24
25      Point p, *pPtr, list[10];
```

13. Which of the following statements is not valid given the Point declarations on line 25?

    a. `cout << p.getX();`
    b. `p.setX(5);`
    c. `p.getName();`
    d. `p.x = 3;`
    e. All of the above are valid.

14. Which of the following will be printed by the following command? `p.print();`

    a. `[0, 0]`
    b. `[1, 1]`
    c. `[2, 2]`
    d. Cannot be determined from information given.
    e. The code causes a compiler error.

15. Given the code on line 25, how many times is the `Point` constructor called?

    a. 1 b. 2 c. 3 d. 11 e. 12

16. Which of the following is true regarding the template designation?

    a. Template is not a legal syntactical designation.
    b. Templates are used to specify the format of a given function.
    c. Templates allow for functions and classes to work for multiple data types.
    d. Templates will only work with variables designated as float or double type.
    e. Templates provide default values for function parameters.

Use the following code for questions 17 & 18.

```
1       int  i =3;
2       int& j = i;
3       int* pi;
4
```

17. What is the type of the variable `j`?

    a. int
    b. pointer to an int
    c. array of int
    d. address of an int
    e. None of the above

18. What is the type of the variable `pi`?

    a. int
    b. pointer to an int
    c. array of int
    d. address of an int
    e. None of the above

19. Which operator is used to de-reference a pointer?

    a. & b. % c. = d. / e. *

Use the following code for questions 20 & 21.

```
1   int i, list[5], j=2;
2   for (i=0; i<5; i++)
3      list[i] = ++j * i * 1.5;
4   cout << i << j;
```

20. After the completion of the code, what is the value of list[4]?

a. 42
b. 27
c. Cannot be determined from the information given.
d. 5
e. Using a floating point number with an integer will cause a compiler error.

21. What is printed by the last statement in the code?

a. 47 b. 48 c. 57 d. 58 e. None of the above.

Use the following code for questions 22, 23, & 24.

```
1         void func1(void);
2
3         int main() {
4            int numb = 10;
5            func1();
6            for (int i = 0; i < 10;i++)
7               func1();
8            return 0;
9         }
10
11        void func1(void) {
12           static int numb = 0;
13           cout << numb++ << endl;
14        }
```

22. The statement on line 1 is known as _____.

a. A null function
b. A void function
c. A static function
d. A comment line
e. A function prototype

23. What will be the last value output?

a. 21 b. 20 c. 9 d. 11 e. 10

24. When the program terminates, what is the value of the variable declared on line 12?

a. 0 b. 1 c. 10 d. 11 e. 21

Use the following code for questions 25 thru 29.

```
1   int main() {
2      int dividend, divisor, result;
3      try {
4         cout << "Enter the dividend: ";
5         cin >> dividend;
6         cout << endl << "Enter the divisor: ";
7         cin >> divisor;
8         if (divisor == 0)
9            throw (" ");
10        result = dividend / divisor;
11        cout << endl << "The result is: " << result << endl;
12     } catch (...) {
13        cout << "wrong" << endl;
14     }
15  }
```

25. What will be output if the user enters 12 for the dividend and 4 for the divisor?

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

26. What will be output if the user enters 12 for the dividend and 5 for the divisor?

a. 0 b. 2 c. 2.4 d. 3 e. wrong

27. What will be output if the user enters 12 for the dividend and 0 for the divisor?

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

28. If the / is exchanged with a % on line 10 and the user enters 12 for the dividend and 5 for the divisor, what will be output?

a. 0 b. 2 c. 2.4 d. 3 e. wrong

29. The code used on lines 3, 9, and 12 can best be described as:

a. Exception handling
b. Catching errors
c. Throwing errors
d. Runtime errors
e. Compiler errors

30. Which of the following operators does not involve a comparison?

a. != b. < c. >= d. += e. All involve comparison.