



**ENGINEERING
AT ILLINOIS**

2017 Academic Challenge

COMPUTER SCIENCE TEST – SECTIONAL

– This Test Consists of 30 Questions –

Computer Science Test Production Team

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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. 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!

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WYSE – Academic Challenge
Computer Science Test (Sectional) – 2017

Use the following code for Questions 1, 2, & 3.

```
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 getPerimeter() const { return 2*width+2*length; }
7           float getArea()      const { return width*length;   }
8           void setLength(float l) { length = (l > 0) ? l : 5; }
9           void setWidth (float w) { width  = (w > 0) ? w : 5; }
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      // end Rectangle class
19
20      Rectangle a(1,3), b(0, 0), c[5];
```

1. Given the code above, which one of the following statements is not true?
 - a. The length of object a is 1.
 - b. The constructor will be called seven times.
 - c. The area of c[2] is 1.
 - d. The following statement will set the width of b to seven: b.width = 7;
 - e. The array c contains 5 rectangles.

Now use the class defined above along with the following code for the Questions 2 & 3.

```
21  for (int i=0; i<5; i++) {
22      c[i].setWidth(i*i+2);
23      c[i].setLength(i+1);
24  }
25  cout << c[2].getArea() << " " << c[3].getPerimeter();
```

2. Which of the following will be printed by the code on line 25?
 - a. 23
 - b. 14
 - c. 6 18
 - d. 18 30
 - e. None of the above.
3. The parameter named length will be accessed how many times as the code on lines 21-25 is executed?
 - a. 2
 - b. 5
 - c. 6
 - d. 7
 - e. 0

4. Which of the following is not true regarding searching and sorting?
- A bubble sort of n items is $O(n^2)$.
 - Searching an unordered list of n items is $O(n)$.
 - The merge and quick sort have best cases of $O(n \cdot \log(n))$.
 - A binary search will start with middle item in the list.
 - Using a binary search of an ordered list of n items is $O(n \cdot \log(n))$.
5. Determine the contents of a queue after the following ENQUEUE and DEQUEUE operations are executed. Assume that the queue is empty before the operations are executed.

ENQUEUE – adds item to end of queue

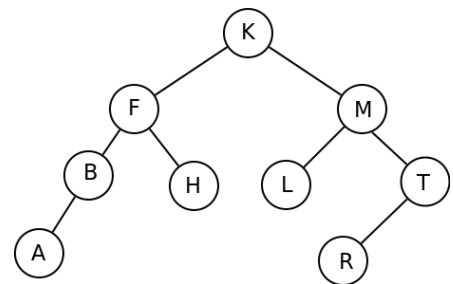
DEQUEUE – removes the item at the front of the queue and returns that value

ENQUEUE (F) ; ENQUEUE (T) ; ENQUEUE (G) ; ENQUEUE (DEQUEUE ()) ; DEQUEUE () ;
ENQUEUE (C) ;

- GFC
 - FTC
 - TGC
 - CFT
 - Cannot be determined.
6. Which of the following statements is not true regarding tree structures?
- Leaves of a tree have no children.
 - A tree with 6 nodes has 5 edges.
 - An unbalanced binary search tree (BST) is not as efficient at searching for elements in the tree as a balanced BST.
 - A tree is a graph with no loops.
 - A binary tree has nodes that have exactly two children.

7. What is the in-order traversal of the tree to the right?

- ABFHKL MRT
- KFB AHMLTR
- ABHFLRTMK
- KFMBHLTAR
- ARBHLTFMK



8. Add the following binary numbers and determine the output in decimal.

$$\begin{array}{r} 10101111 \\ + 01001101 \\ \hline \end{array}$$

- 11111100
- FD
- 252
- 175
- 77

9. Convert the following binary number to base 10 (the binary number has a decimal point in it).

1011.0110

- a. 11.375 b. -11.5 c. 11.6 d. B.6 e. None of the above.

10. Which of the logical expressions is equivalent to the following expression?

$(AB \text{ OR } BC)'$

- a. $(AB)' \text{ OR } (BC)'$ b. $A'B' \text{ OR } B'C'$
 c. $AB \text{ AND } BC$ d. $(AB)' \text{ AND } (BC)'$
 e. Both a and b

11. Determine the value of the output of the following truth table.

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

- a. $ABC + B'C + A'BC$ b. C'
 c. $ABC + A'BC$ d. $B'C$
 e. None of the above.

12. Which of the following is a microblogging site?

- a. Facebook b. Twitter
 c. YouTube d. Google+
 e. Pinterest

13. Which of the following is a purely digital currency?

- a. PayPal b. Bitcoin
 c. Visa d. Barclays
 e. American Express

14. Which of the following lists is in order by slowest access time to fastest access time?

- DVD, cache, register, RAM
- RAM, DVD, cache, register
- DVD, RAM, cache, register
- cache, register, DVD, RAM
- DVD, RAM, register, cache

15. What is the purpose of pentesting?

- To determine if a printer has enough ink.
- To test a computer system to find vulnerabilities that an attacker could exploit.
- To test a computer system to determine if it meets its functional requirements.
- To determine if a computer correctly interprets handwriting.
- To assist in the compiling of an application program.

Use the following code for Questions 16, 17, and 18.

```

1   int mult(int a, int b){
2       a = a*b;
3       return a;
4   }
5   int add(int& a, int b){
6       a = a+b;
7       return a;
8   }
9   int main(){
10      int a = 0;
11      int ans = 0;
12      for (int i=0;i<4;i++) {
13          ans = mult(a,i);
14          ans = add(a,i);
15          cout << i << " " << a << " " << ans << endl;
16      }
17      return 0
18  }
```

16. What will be the last line of output from the code?

- 4 0 -4
- 0 0 0
- 2 3 3
- 3 6 6
- None of the above.

17. How is the first parameter passed to the function `mult()`?

- The variable is passed by value.
- The variable is passed by reference.
- The variable is passed by pointer.
- The variable is passed as global.
- None of the above.

18. How is the first parameter passed to the function `add()`?

- The variable is passed by value.
- The variable is passed by reference.
- The variable is passed by pointer.
- The variable is passed as global.
- None of the above.

Use the following code for Questions 19, 20, 21, and 22.

```

1
2   int myfunc(int a, int b) {
3       static int c = 0;
4       cout << ++c << " ";
5       int retval = b;
6       if (a % b != 0) {
7           retval = myfunc(b, a%b);
8       }
9       return retval;
10  }
```

19. What is returned by the following function call?

```
myfunc(200, 20);
```

- 1
- 10
- 20
- 200
- None of the above.

20. What is displayed by the screen for the following function call?

```
myfunc(35, 300);
```

- Nothing is displayed
- 5
- 0 1 2 3
- 1 2 3 4
- 1 2 3 4 5

21. What is returned by the following function call?

```
myfunc(35, 300);
```

- Nothing is displayed
- 5
- 35
- 300
- 8

22. Which one of the following is not true regarding the function?

- The function is a recursive function.
- The base case is when $a\%b$ does not equal 0.
- The recursive call is `myfunc(b, a%b)`.
- The static variable `c` tracks the number of times the function is called.
- This function uses integer data types.

Use the following code for Questions 23 through 26.

```

1 void my_func (char a[]) {
2     int i=0;
3     do {
4         a[i] -= 1;
5         i++;
6     } while (a[i] != '\0');
7 }
8 int main () {
9     char n[3];
10    cin >> n;
11    my_func(n);
12    cout << n;
13    return 0
14 }
```

23. Which of the following would be invalid input from the user?

- Hello
- 2*3
- 43
- 0\
- All are valid

24. The do loop in `my_func` is which type of loop?

- Pretest
- Inline test
- Multiple test
- Backwards test
- Posttest

25. What is the purpose of `'\0'` on line 6?

- It is used to check for two zeroes in a row.
- It represents a blank character.
- It indicates that the loop needs to be executed while $i = 0$.
- It is a syntax error.
- It is used to check for the end of a string.

26. What will the output be if the user entered the string IBM ?

- a. IBM
- b. JCN
- c. HAL
- d. ABC
- e. 123

Use the following code for Questions 27, 28, 29, 30.

```

1  int i=0;
2  void my_func (int k) {
3      for (int j=k;j<5;j++) {
4          for (i;i<5;i++)
5              cout << "Hey";
6      }
7  }
8  int main ()
9  {
10     int n;
11     cin >> n;
12     my_func(n);
13     return 0;
14 }
```

27. What is the scope of the variable `i` used on line 4?

- a. Local to the `for` loop that begins on line 4
- b. Local to the `for` loop that begins on line 3
- c. Local to the `my_func` function
- d. Global
- e. None of the above.

28. What is the scope of the variable `k` used on line 3?

- a. Local to the `for` loop that begins on line 4
- b. Local to the `for` loop that begins on line 3
- c. Local to the `my_func` function
- d. Global
- e. None of the above.

29. How many times will “Hey” be output if the user enters 2?

- a. 0
- b. 5
- c. 10
- d. 15
- e. 20

30. How many times will “Hey” be output if the user enters 5?

- a. 0
- b. 5
- c. 10
- d. 15
- e. 20