



**ENGINEERING
AT ILLINOIS**

2017 Academic Challenge

COMPUTER SCIENCE TEST – REGIONAL

– This Test Consists of 30 Questions –

Computer Science Test Production Team

Jim Feher, Washington University in St. Louis – Author

Nathan White, Central Washington University – Author

Kevin Schaefer, Independent Consultant - Reviewer

Sahid L. Rosado Lausell, WYSE – Coordinator of Test Production

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!

©2017 Worldwide Youth in Science and Engineering

“WYSE”, “Worldwide Youth in Science and Engineering” and the “WYSE Design” are service marks of and this work is Copyright ©2017 by the Board of Trustees of the University of Illinois at Urbana – Champaign.

All rights reserved

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

1. Which of the following statements is true regarding the public, private, and protected class declarations?
 - a. Public items must be accessed with the dot operator within the class.
 - b. Private items are not directly accessible to friends of the class.
 - c. Protected items are only accessible outside the class by classes that inherit the class containing them.
 - d. Protected and public items behave similarly outside of the class.
 - e. Both c and d are correct.

2. Using accessor methods such as getValue and setValue is an example of which principal of object oriented programming?
 - a. encapsulation
 - b. inheritance
 - c. abstraction
 - d. polymorphism
 - e. None of the above.

3. Which of the following statements is true regarding the constructors and destructors for a class?
 - a. A constructor is called by the programmer when they wish to set the values of the object.
 - b. Destructors for class objects are called in the reverse order in which the objects were created.
 - c. Each class may only have one constructor.
 - d. The programmer has the ability to name the destructor as they wish.
 - e. When declaring an array of objects, the constructor is called once for the array.

4. Convert the following binary number 10010010 into decimal (base 10).
 - a. 10010010
 - b. -10010
 - c. 146
 - d. 154
 - e. 92

5. Which column of the following truth table represents the following logical expression?

(A and B) or (not B and C)

A	B	C	1	2	3	4	5
F	F	F	F	F	F	T	F
F	F	T	F	T	T	T	F
F	T	F	F	F	F	F	F
F	T	T	F	F	F	F	F
T	F	F	F	F	F	F	T
T	F	T	F	T	T	T	T
T	T	F	T	T	F	T	T
T	T	T	T	T	F	F	T

- a. 1
- b. 2
- c. 3
- d. 4
- e. 5

6. Which of the following logic gates is an Exclusive OR (XOR) gate?



- a. i b. ii c. iii d. iv e. v

7. Which of the following is not true regarding 2's complement numbers?

- They represent integer values.
- They can represent positive and negative values.
- They only have one way to represent the value of zero.
- They simplify the way subtraction is done at the hardware level.
- An 8 bit 2's complement number has a maximum value of 255.

8. Which if any of the following is not true regarding linked lists and arrays?

- It is harder to jump to a specific element in a linked list than in an array.
- To store the same number of elements, an array will take up less memory.
- The size of a linked list can grow and shrink dynamically during the program execution.
- Linked lists and arrays can both be used to implement Queue data structures.
- Link lists may not be used with user defined data types.

9. For which of the following data structures does the order in which the items are added to the structure dictate where in the structure they are stored?

- Trees and Linked Lists
- Stacks and Hashes
- Stacks and Queues
- Linked Lists and Hashes
- Stacks, Queues, Hashes, Linked Lists, and Trees

10. A given algorithm requires $n \cdot \log_2 n + 100 \cdot n^{3/2} + \frac{(n+3)^4}{n}$, steps. This algorithm is Big-O of which of the following?

- a. $O(n^3)$ b. $O(n \cdot \log_2 n)$ c. $O(100 \cdot n^{3/2})$ d. $O(n^{3/2})$ e. $O(n)$

11. _____ are small data files that are deposited on your hard disk from websites you have visited.
- a. Cookies
 - b. Icons
 - c. Bookmarks
 - d. Plug-ins
 - e. None of the above
12. Which of the following is NOT an acceptable practice for creating passwords?
- a. Use a password with at least eight characters.
 - b. Do not use your user name, real name, or school name in your password.
 - c. Do not use a complete word.
 - d. Create a password that contains at least one of each of the following characters: uppercase letter, lowercase letter, number, and symbol.
 - e. Reuse passwords as much as possible.
13. How many bytes can a computer that uses a 32-bit word access at one time?
- a. 1
 - b. 2
 - c. 4
 - d. 8
 - e. 16
14. _____ memory appears to exist as primary storage although most of it is supported by data held in secondary storage, with transfers between the two made automatically as required.
- a. Random
 - b. Large
 - c. Virtual
 - d. Overflow
 - e. None of the above.
15. Which of the following is not a unary operator?
- a. !
 - b. ++
 - c. --
 - d. %
 - e. All are unary operators.

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

```

1   int a = 6, b = 2, c = 10;
2   cin >> a;           // get input from user
3   if (a > b)
4       c += a%3;
5   else
6       c = (a < 0) ? b : b++;
7   cout << a << b << c; // display variables

```

16. How many arithmetic operators are in the code?
- a. 0
 - b. 1
 - c. 2
 - d. 3
 - e. More than 3

17. If the user types in a 5, what will be displayed?

- a. 6210 b. 5210 c. 5213 d. 521 e. None of the above.

18. If the user types in a 0, what will be displayed?

- a. 6210 b. 022 c. 0210 d. 032 e. 023

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

```

1     int fun1(int x, int y) {
2         int z = x++;
3         if (x%2 == 1)
4             y += 2;
5         return x + z;
6     }
7     int fun2(int x, int &y) {
8         int z = x++;
9         if (x%2 == 1)
10            y += 2;
11        return x + z;
12    }
13    int fun3(int x, int *y) {
14        static int z;
15        z += x++;
16        if (x%2 == 1)
17            y += 2;
18        return x + z;
19    }

```

19. Which of the following is true regarding the function headers for `fun1`, `fun2` and `fun3`?

- a. `fun1` and `fun2` use pass by value.
b. `fun2` and `fun3` use pass by reference.
c. All of the functions use pass by reference.
d. Statements a and b are true, but c is false.
e. Statements a, b, and c are all true.

20. What is printed by the following code?

```

int x=1, y=2, z=3;
cout << fun1(y, y);
cout << x << y << z << endl;

```

- a. 123 b. 2123 c. 4243 d. 5123 e. None of the above.

21. What is printed by the following code?

```
int x=1, y=2, z=3;
cout << fun2(y, y);
cout << x << y << z << endl;
```

- a. 123 b. 2123 c. 4243 d. 5123 e. None of the above.

22. Which of the following statements is true regarding fun1, fun2, and fun3?

- a. fun3 will not compile due to the use of the static variable.
 b. This is a legal function call: fun3(x, &x);
 c. This is a legal function call: fun2(5, 5);
 d. This is a legal set of function calls: fun2(fun1(x,x), fun2(y,y));
 e. None of the statements above are true.

23. Which of the following is not true regarding loop control structures?

- a. The for and while loops are pretest loop structures.
 b. A do while loop may never have its internal code run.
 c. Counter controlled loops run a specific number of times.
 d. The do while, while and for may all be used as sentinel controlled loops.
 e. The for loop allows the programmer to initialize and update data within the structure.

Use the following code for Questions 24, 25, 26, and 27.

```
1  int i, j, A[5] = {1, 2, 3, 4, 5};
2  cin >> j; // Allow user to enter number
3  for (i=0; i<5; i++)
4      if (j)
5          A[i] += i;
6      else
7          A[i] = ++j;
8  cout << i << j << A[0] << A[4];
```

24. If the user enters a 4 at line 2, how many times does the code in line 4 execute?

- a. 0 b. 1 c. 4 d. 5 e. Cannot be determined.

25. If the user enters a 4 at line 2, how many times does the code in line 7 execute?

- a. 0 b. 1 c. 4 d. 5 e. Cannot be determined.

26. If the user enters a 4 at line 2, what is displayed on line 8 at the conclusion of the code?
- a. 5419 b. 5415 c. 4415 d. 4915 e. None of the above.
27. If the user enters a 0 at line 2, what is displayed on line 8 at the conclusion of the code?
- a. 5419 b. 5415 c. 4415 d. 4915 e. None of the above.

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

```

1      const int MAX_SIZE = 4;
2      int a = 10;
3      int b = 20;
4      int c = 30;
5      int d = 40;
6      int e[MAX_SIZE];
7      int j=0;
8          // line where MAX_SIZE = 5 would go (Q30)
9      e[j++] = a;
10     e[j++] = b;
11     e[++j] = c;
12     e[j] = d;
```

28. What is the value of the array element `e[1]`?
- a. 10 b. 20 c. 30 d. 40 e. Unable to determine
29. What is the value of the array element `e[2]`?
- a. 10 b. 20 c. 30 d. 40 e. Unable to determine
30. What would happen if the following line of code were added at line 8?
- ```
MAX_SIZE = 5;
```
- a. The array would be reinitialized and have 5 elements.  
b. The array would not be reinitialized, but would be increased to a total of 5 elements.  
c. The array would not be reinitialized, but would be increased by 5 elements to a total of 9 elements.  
d. The code would no longer compile.  
e. Nothing. The line of code would be skipped.