



**ENGINEERING  
AT ILLINOIS**

## 2018 Academic Challenge

### COMPUTER SCIENCE TEST – REGIONAL

– 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 (Regional) – 2018

1. Which of the following IP address(es) are non-routable?
  - A. 192.168.0.1
  - B. 10.16.0.6
  - C. 8.8.8.8
  - D. Both A and B
  - E. None of the above
  
2. Which of the following statements are correct regarding Transmission Control Protocol (TCP) and User Datagram Protocol (UDP)?
  - A. UDP is less reliable as it does not have built-in acknowledgement, as does TCP
  - B. TCP generally has more data and processing overhead
  - C. UDP generally has a higher throughput than TCP
  - D. UDP does not have built-in mechanisms for handling out-of-order messages
  - E. All of the above
  
3. Symmetric key encryption and asymmetric key encryption can best be described by which of the following?
  - A. Symmetric key encryption generally requires less overhead than asymmetric key encryption
  - B. Asymmetric key encryption, sometimes known as public key/private key encryption, requires that devices on both ends of the transmission share a common trusted party.
  - C. Asymmetric key encryption is only used for broadcast transmissions, since there is only one transmitter, but multiple receivers
  - D. Transmissions secured using SSL (i.e., secure sockets layer) start by using asymmetric key encryption, but usually switch to using symmetric key encryption after the initial SSL handshake
  - E. Answers A, B, and D are correct
  
4. Dynamic Host Configuration Protocol (DHCP) is best described by which of the following:
  - A. Translates hostnames into IP addresses
  - B. Alerts other devices on a network that a printer is being shared
  - C. Provides a device on a network with an IP address and other information so it can communicate over that network
  - D. Provides a mechanism for load balancing web requests among multiple backend servers
  - E. Both A and C are correct

5. Convert 11010100 from binary (base-2) to decimal (base-10):

- A. 212
- B. 11010100
- C. -00101011
- D. 424
- E. 106

6. Given the following expression, what is an equivalent expression if  $z$  is true?

$$x \vee (\neg y \wedge z) \vee (\neg x \wedge z)$$

- A.  $x \vee \neg y$
  - B. true
  - C.  $x \vee \neg(y \vee x)$
  - D. false
  - E. None of the above
7. Suppose the following two binary values are represented with two's complement representation, what is the answer in decimal?  $00000110 + 11110111$

- A. 3
- B. -3
- C. 253
- D. -2
- E. 2

8. Which of the following logical operators is equivalent to this logic gate?



- A. NAND
- B. OR
- C. NOR
- D. XOR
- E. AND

9. Which column of the following truth tables represents this logical expression?

$$\neg(x \vee z) \vee \neg y$$

x	y	z	A	B	C	D	E
F	F	F	T	T	T	F	T
F	F	T	T	T	T	F	T
F	T	F	T	F	F	T	T
F	T	T	T	F	T	T	F
T	F	F	T	T	T	F	T
T	F	T	T	F	T	F	T
T	T	F	F	F	T	T	F
T	T	T	T	F	T	T	F

A. A

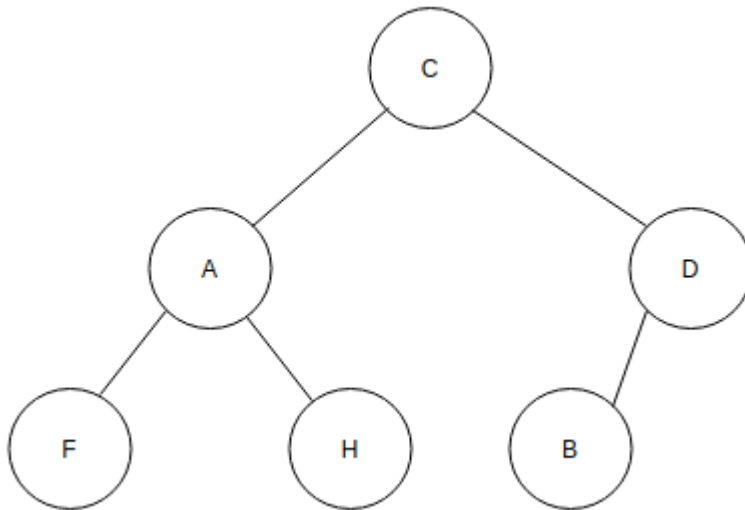
B. B

C. C

D. D

E. E

Use the following tree for Questions 10 and 11:



10. What is the Post Order traversal of the tree?

- A. BDHFAC
- B. FHABDC
- C. CAFHDB
- D. DBCHAF
- E. CDBAHF

11. What statement is true regarding the tree?

- A. The tree is a balanced binary tree
- B. The tree is a graph with exactly one cycle
- C. The tree has a height of 3, has 6 nodes, and 5 edges
- D. Both A and C are correct
- E. None of the above

Use the following code for Questions 12, 13, and 14:

```
int fun(int a)
{
    if(a <= 1)
        return a;
    else
        return fun(a - 1) + fun(a - 2);
}

int main()
{
    int a;
    cin >> a;

    cout << fun(a);

    return 0;
}
```

12. If the user enters 5 when prompted, what will be printed to standard output?

- A. 3
- B. 8
- C. 5
- D. 1
- E. None of the above

13. If the user enters 5 when prompted, how many times will the function fun be called?

- A. 1
- B. 7
- C. 12
- D. 14
- E. 15

14. How many ternary operators are there in fun?

- A. 0
- B. 1
- C. 2
- D. 3
- E. 4

Use the following code for Questions 15, 16, and 17:

```
int gcd(int a, int b)
{
    if (b == 0)
        return a;
    else
        return gcd(b, a % b);
}
```

15. The function gcd can best be described by which of the following

- A. Recursive
- B. Iterative
- C. Modulus
- D. Public
- E. Protected

16. How many times will the gcd function be called with this call: gcd(4, 2)

- A. 0
- B. 1
- C. 2
- D. 3
- E. Infinite

17. What will the result be when calling the function with gcd(4, 2)

- A. 0
- B. 2
- C. 4
- D. 6
- E. The function infinitely calls itself, so it will never return an answer

Use the following code for Questions 18, 19, and 20:

```
int funA(int &a, int b)
{
    b = a++ % b;
    return b > 3 ? 0 : ++a;
}

int main()
{
    int a = 12, b = 10; // Line for question 20
    cout << funA(a, b) << " ";
    cout << a << " ";
    cout << b << endl;

    return 0;
}
```

18. How many unary operators are present in funA?

- A. 0
- B. 1
- C. 2
- D. 3
- E. 4

19. What will be printed to the screen?

- A. 14 14 10
- B. 14 12 10
- C. 0 13 10
- D. 0 14 10
- E. 13 14 10

20. If the code marked with "// Line for question 20" was changed to "int a = 15, b = 10;", what will be printed to the screen?

- A. 13 14 10
- B. 0 15 10
- C. 0 16 10
- D. 17 17 10
- E. 0 17 10



Use the following code for Questions 21, 22, and 23:

```
int a = 0;
int i;
for(i = -4; i <= 4; i+= 2)
    a += i;
```

21. What value will the variable a contain after running?

- A. 0
- B. -4
- C. 4
- D. -6
- E. 6

22. If i was initialized with 0 instead of -4, then what would the variable a contain after running?

- A. 0
- B. -4
- C. 4
- D. -6
- E. 6

23. What value will i have after running, assuming that i is initialized with 0 instead of -4?

- A. 0
- B. -4
- C. 4
- D. -6
- E. 6

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

```
int arr1[] = {1, 2, 3, 4, 5};
int arr2[] = {5, 4, 3, 2, 1};

int x, y;

for(x = 0; x < 5; x++)
    for(y = x; y < 5; y++)
        arr1[x] += arr2[y];

for(int i = 0; i < 5; i++)
    cout << setw(3) << i << " " << arr1[i] << endl;
```

24. What will the contents of arr1 be after the code executes?

- A. {1, 2, 3, 4, 5}
- B. {5, 4, 3, 2, 1}
- C. {16, 12, 9, 7, 6}
- D. {16, 17, 18, 19, 20}
- E. {6, 7, 9, 12, 16}

25. What is the purpose of endl in the code?

- A. It terminates the program
- B. It inserts a newline character into the output stream
- C. It flushes the output stream
- D. Both B and C
- E. None of the above

26. What are the values of variables x and y after the code executes?

- A. x: 4, y: 4
- B. x: 5, y: 4
- C. x: 4, y: 5
- D. x: 5, y: 5
- E. None of the above

27. If arr1 was initialized as `int arr1[] = { 1, 2, 3, 4, 5, 6 }`, what would the contents of arr1 be after the code executes?

- A. {16, 12, 9, 7, 6, 6}
- B. {16, 12, 9, 7, 6, 0}
- C. {16, 11, 6, 3, 1}
- D. Segmentation fault
- E. Compiler error

Use the following class header for Questions 28, 29, and 30:

```
class cardDeck
{
    private:
        const char FACES[14] = "A234567890KQJ";
        const char SUITS[5] = "CHSD";
        int numValues[52];
        char suits[52];
        void shuffle();
        void initCards();
        void swap(int &a, int &b);
        void swap(char &a, char &b);
    public:
        cardDeck();
        cardDeck(bool shuffleCards);
        int getNumValue(int i);
        char getSuitValue(int i);
        void printCard(int i);
};
```

28. Which of the following statements are correct regarding this class?

- A. Once declared, values in the numValues or suits arrays cannot be changed outside of the class
- B. getNumValue and getSuitValue are examples of encapsulation
- C. If a new class inherited the class cardDeck, it would have direct access to call shuffle()
- D. Both A and B are correct
- E. All of the above

29. Which of the following code snippets will result in a compile-time error, given an instance of the class has been declared using cardDeck c;?

- A. c.getSuitValue(100);
- B. c.numValues[2]++;
- C. c = new cardDeck(true);
- D. cout << c->FACES[9];
- E. Multiple lines above will cause a compile time error

30. Which of the following is not an aspect of object oriented programming?

- A. Abstraction
- B. Inheritance
- C. Polymorphism
- D. Recursion
- E. Encapsulation