

# Academic Challenge



EASTERN ILLINOIS UNIVERSITY

## 2019 Academic Challenge

### COMPUTER SCIENCE TEST – REGIONAL

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**

**Number of Questions: 30**

**DO NOT OPEN TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO!**

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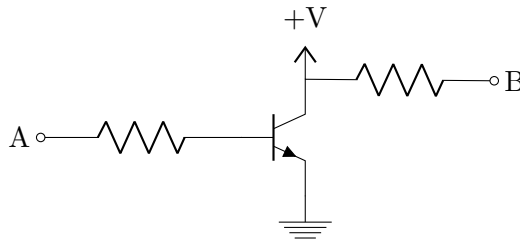


Academic Challenge  
Computer Science Test (Regional) - 2019

1. Which of the following is not an example of a public cloud platform?

- A. Google Cloud Platform (GCP)
- B. Amazon Web Services (AWS)
- C. Microsoft Azure
- D. Github
- E. IBM Cloud

2. Which of the truth tables is logically equivalent to the following circuit?



A. 

A	B
F	F
T	T

B. 

A	B
F	T
T	T

C. 

A	B
F	T
T	F

D. 

A	B
F	F
T	F

E. None of the above

3. Which of the following best describes the HyperText Transfer Protocol (HTTP)?

- A. A protocol by which rich-text email is sent between mail hosts.
- B. A protocol by which documents can be accessed over the Internet.
- C. A synonym for HTML (HyperText Markup Language).
- D. A protocol by which documents are sent to printers.
- E. None of the above.

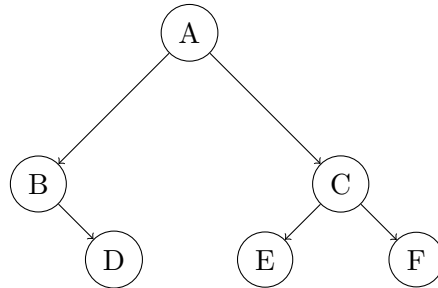
Use the following code for questions 4 and 5.

```
1 #include <iostream>
2 using namespace std;
3
4 int main()
5 {
6     int i;
7     for(i = 0; i < 5; ++i)
8     {
9         cout << i;
10    }
11
12    cout << i;
13
14    return 0;
15 }
```

4. What is the output of the code?
  - A. 012345
  - B. 012340
  - C. 0123456
  - D. 0123450
  - E. None of the above
  
5. How many times is the conditional in the for-loop executed?
  - A. 0
  - B. 1
  - C. 4
  - D. 5
  - E. 6
  
6. Which of the following statements is true regarding RISC (Reduced Instruction Set Computing) and CISC (Complex Instruction Set Computing) CPU architectures?
  - A. Computers were first build with RISC architectures, but later moved to CISC architectures are CPU manufacturing technologies improved.
  - B. Multiple RISC instructions may be required to perform the task of one CISC instruction.
  - C. The Arithmetic and Logic Unit (ALU) of a CPU is typically built using a CISC architecture due to the complex nature of instructions it requires.
  - D. Both A and C.
  - E. None of the above

7. Which of the following is not an example of a computer operating system?
- Microsoft Windows
  - Ubuntu Linux
  - Kernel
  - macOS
  - All of the above are examples of operating systems

Use the following tree for questions 8 and 9.



8. What is the Post-Order Traversal of the tree?
- ABCDEF
  - FEDCBA
  - FECDBA
  - DBEFCA
  - None of the above
9. Which statement is true regarding the tree?
- The tree is also a Binary Tree.
  - The tree is not a graph because it is not complete.
  - Nodes A, B, and C are all root nodes.
  - The degree of node C is 0 because nodes E and F are leaf nodes.
  - The tree is not a graph because it has no cycles
10. Convert 01000111 from binary to decimal.
- 107
  - 142
  - 01000111
  - 47
  - 71

Use the following code for questions 11 and 12.

```
1 #include <iostream>
2 using namespace std;
3
4 int fun1(int a[], int b)
5 {
6     int c = 0;
7
8     while(b--)
9     {
10         c += a[b];
11     }
12
13     return c;
14 }
15
16 int main()
17 {
18     int a[] = { 1, 2, 3, 4, 5 };
19     int b[] = { -1, 0, 1, 2 };
20
21     cout << fun1(a, 5)
22          << ", "
23          << fun1(b, 4);
24
25     return 0;
26 }
```

11. What is printed to the screen?

- A. 15, 2
- B. 10, 0
- C. 14, 3
- D. 2, 15
- E. 0, 10

12. If the declaration for variable `c` in `fun1` were changed to `static int c = 0;`, what would the output be?

- A. 15, 2
- B. 15, 17
- C. 10, 0
- D. 0, 0
- E. The code does not compile

Use the following instructions for a hypothetical CPU to answer questions 13 and 14.

Operation	Meaning
POP	Removes the item from the front of the list
PUSH	Pushes the specified value to the end of the list
MULT	Multiplies the two items from the front of the list and pushes the result to the end of the list
ADD	Adds the two items from the front of the list and pushes the result to the end of the list

13. What are the contents of the list after executing the following commands:

```
PUSH 2
PUSH 4
PUSH 8
PUSH 3
ADD
MULT
```

- A. 16 48
- B. 48 16
- C. 96 2
- D. 6 24
- E. 24 8

14. What data structure is being utilized?

- A. Array
- B. Stack
- C. Queue
- D. Linked List
- E. None of the above

Use the following code for questions 15 and 16.

```
1 char up(char a)
2 {
3     return a - 'a' + 'A';
4 }
```

15. What is the result of the function call `up('a')`?

- A. 0x31
- B. 'a'
- C. -a
- D. The code does not compile
- E. 'A'

16. What is the result of the function call `up('g')`?
- A. 'g'
  - B. The code does not compile
  - C. -g
  - D. 'G'
  - E. 0x37
17. How many ways can 0 be represented in One's Complement Notation?
- A. 0
  - B. 1
  - C. 2
  - D. 3
  - E. The number of representations of 0 depends on the maximum bit length of the number.
18. Hypertext Transport Protocol (HTTP) is a part of which layer of the Open Systems Interconnect (OSI) Model?
- A. Application Layer
  - B. Internet Layer
  - C. Physical Layer
  - D. Presentation Layer
  - E. Session Layer
19. What is the Time-Complexity of a linear search expressed in Big-Oh Notation?
- A.  $O(1)$
  - B.  $O(n)$
  - C.  $O(n^2)$
  - D.  $O(\log(n))$
  - E.  $O(2n)$



Use the following code for questions 20, 21, 22, and 23.

```
1 #include <iostream>
2 using namespace std;
3
4 int addSum(int a, int &b);
5
6 int main()
7 {
8     int a = 4, b = 5;
9     cout << addSum(a, b) << " ";
10
11     a = 3;
12     cout << addSum(a, b);
13
14     return 0;
15 }
16
17 int addSum(int a, int &b)
18 {
19     return b = a + b;
20 }
```

20. What is the code on line 4 called?

- A. Function Prototype
- B. Empty Function
- C. Null Function
- D. Function Pre-declaration
- E. The code on line 4 is not necessary in this context

21. What is the output of the code?

- A. 9 12
- B. 9 8
- C. 0 0
- D. 8 9
- E. None of the above

22. Suppose line 19 was changed to `return b = a + --b`. What would the output of the code be?

- A. 9 12
- B. 9 11
- C. 8 9
- D. 8 10
- E. 8 11

23. In the function call `addSum(a, b)` on line 9, how is `b` being passed to the function?

- A. Passing by value
- B. Passing by reference
- C. Passing by pointer
- D. Both A and C are correct
- E. None of the above

Use the following code for questions 24, 25, and 26.

```
1 #include <iostream>
2 using namespace std;
3
4 enum Color { Black, LightBrown, White, Red };
5
6 class Mammal
7 {
8     protected:
9         string name;
10        float age;
11        bool isAwake;
12    public:
13        Mammal(string name, float age);
14        void Sleep();
15        void Wakeup();
16        string GetName() { return this->name; };
17        float GetAge() { return this->age; };
18 };
19
20 class Dog : public Mammal
21 {
22     private:
23         Color furColor;
24     public:
25         Dog(string name, float age, Color furColor);
26         void Bark() { cout << "Bark!!"; };
27         Color GetFurColor() { return this->furColor; };
28 };
```

*Code continues on next page.*

```
29 Mammal::Mammal(string name, float age)
30 {
31     this->name = name;
32     this->age = age;
33     this->isAwake = true;
34 }
35
36 void Mammal::Sleep()
37 {
38     if(!this->isAwake)
39         throw("I'm already sleeping! Please wake me up first.");
40
41     this->isAwake = false;
42 }
43
44 void Mammal::Wakeup()
45 {
46     if(this->isAwake)
47         throw("I'm already awake! Please have me to go sleep first.");
48
49     this->isAwake = true;
50 }
51
52 Dog::Dog(string name, float age, Color furColor) : Mammal(name, age)
53 {
54     this->furColor = furColor;
55 }
56
57 float GetAverageAgeOfMammals(Mammal mammals[], int size)
58 {
59     float sum = 0;
60
61     for(int i = 0; i < size; i++)
62         sum += mammals[i].GetAge();
63
64     return sum / size;
65 }
66
67 int main()
68 {
69     Dog d[] = {Dog("Spike", 3.4, Red)};
70
71     cout << GetAverageAgeOfMammals(d, 1) << endl;
72
73     return 0;
74 }
```

24. Which of the following will not cause a compile-time exception, assuming the following declarations exist:
- ```
Dog dogs[] = {Dog("Spike", 2, Red), Dog("Sadie", 1, LightBrown)};
Mammal mammal ("Lucy", 3);
```
- A. `GetAverageAgeOfMammals(dogs, 2);`
  - B. `Mammal newMammal = dogs[0];`
  - C. `dogs[0]->GetAge();`
  - D. `mammal.GetFurColor();`
  - E. Both A and B will not cause a compile-time exception
25. Which of the following statements is false regarding the `Dog` and `Mammal` classes?
- A. Both `Dog` and `Mammal` have a default constructor.
  - B. Functions within the `Dog` class have access to directly modify the `name` property on `Mammal`.
  - C. Functions within the `Mammal` class have access to directly modify the `furColor` property on `Dog`.
  - D. All `Dogs` are also `Mammals`.
  - E. Both A and C
26. Which aspect of Object Oriented Programming allows us to pass an array of `Dogs` to the `GetAverageAgeOfMammals` function?
- A. Encapsulation
  - B. Inheritance
  - C. Polymorphism
  - D. Abstraction
  - E. All of the above
27. Convert 19 from decimal to binary.
- A. 00010011
  - B. 11001000
  - C. 13
  - D. 1011
  - E. 00011001

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

```
1 #include <iostream>
2 using namespace std;
3
4 const int SIZE = 3;
5
6 void fun(int a[3][3])
7 {
8     for(int i = 0; i < SIZE; i++)
9     {
10         for(int j = 0; j < SIZE; j++)
11         {
12             cout << a[j][i] << " ";
13         }
14         cout << endl;
15     }
16 }
17
18 int main()
19 {
20     int a[][3] = { { 1, 2, 3 },
21                   { 4, 5, 6 },
22                   { 7, 8, 9 } };
23
24     fun(a);
25
26     return 0;
27 }
```

28. What is the output of the program?

- A. 1 2 3  
4 5 6  
7 8 9
- B. 1 4 7  
2 5 8  
3 6 9
- C. 3 2 1  
6 5 4  
9 8 7
- D. 9 6 3  
8 5 2  
7 4 1
- E. None of the above

29. Suppose the code on line 4 were changed to `const int SIZE = 2;`, what would the output of the program be?

A. 9 6

8 5

B. 1 4 7

2 5 8

3 6 9

C. 1 2 3

4 5 6

7 8 9

D. 1 2

3 4

E. 1 4

2 5

30. How many unary operators are in function `fun`?

A. 0

B. 1

C. 2

D. 3

E. 4



