



2024 Academic Challenge COMPUTER SCIENCE TEST – SECTIONAL

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!

Academic Challenge
Computer Science Test (Sectional) – 2024

1. Which of the following operations is not allowed on an associative array?
 - A. Add a new key, value pair
 - B. Remove an existing key, value pair
 - C. Add a copy of an existing key, value pair
 - D. Change the value of an existing key, value pair
 - E. Look up and retrieve the value of an existing key, value pair

2. What is a CSV file?
 - A. A file that contains command service vectors
 - B. A file that contains computer start-up values
 - C. A file that contains content security values
 - D. A file that has values separated by colons
 - E. A file that has values separated by commas

3. The octal number 732.4 is represent by the decimal number
 - A. 138.5
 - B. 474.5
 - C. 566.75
 - D. 604.375
 - E. 1842.25

4. Which response best defines the term *daemon*?
 - A. A background process in a multitasking operating system
 - B. An error in a program in the program logic
 - C. An error in a program caused by a random processor error
 - D. An intentional hidden program error made with nefarious intent
 - E. A program that when executed completely stops execution of all other processes

5. What is the parity of the byte 10011011?
 - A. 3
 - B. 5
 - C. odd
 - D. even
 - E. justified

6. Data communication takes place with a BER equal to 10^{-6} . What is the probability that a communicated packet of 10^5 bits has zero errors?

- A. 0.100000
- B. 0.999999
- C. 0.909090
- D. 0.904837
- E. 0.900000

7. The decimal number 73 written in an eight-bit two's complement representation is 01001001. What is the decimal number represented by the eight-bit two's complement result of shifting all the bits one bit to the left and placing a 1 in the right most position? To be clear, the leftmost 0 in the original number is dropped in the shift left process.

- A. 19
- B. -19
- C. 147
- D. -109
- E. -233

8. Which type of data structure is associated with last-in-first-out (LIFO) access?

- A. Queue
- B. Stack
- C. Linked list
- D. Indexed Array
- E. Associative Array

9. What is the Boolean expression that matches the given truth table?

J	K	L	output
F	F	F	T
F	F	T	F
F	T	F	T
F	T	T	F
T	F	F	T
T	F	T	T
T	T	F	F
T	T	T	F

- A. $JK' + K'L'$
- B. $K'L' + J'L'$
- C. $JK' + J'L'$
- D. $J'L'$
- E. None of the above.

10. In big O notation, what is the average performance of a binary search on an ordered array?

- A. $O(0)$
- B. $O(1)$
- C. $O(\log n)$
- D. $O(n)$
- E. $O(n \log n)$

11. The hexadecimal representation of the binary number 1010110011101001 is

- A. ACE9
- B. ADDBA
- C. ADB9
- D. AEAD
- E. 9879

12. What is the decimal representation of the binary number in problem 11?

- A. 38763
- B. 39421
- C. 40407
- D. 42799
- E. 44265

13. The Boolean expression $XY + XY$ is equivalent to

- A. X
- B. $X + Y$
- C. Y
- D. XY
- E. None of the above

A processor has the following assembly language instructions

Symbolic representation	Description
LDA x	Load the value at memory location x into register A
STA x	Copy the value from register A into memory location x
LDB x	Load the value at memory location x into register B
STB x	Copy the value from register B into memory location x
ADDA x	Add the value at memory location x to register A
JNZB y	Jump to program step y if the value of register B > 0
INCB	Increment the value stored in register B by 1
DECB	Decrement the value stored in register B by 1
STL x,d	Store the literal value d to memory location x
NOP	Don't do anything, and move to the next instruction

The following code is processed:

```

0x01 STL 0x20, 0x00
0x02 STL 0x21, 0x05
0x03 STL 0x22, 0x02
0x04 LDA 0x20
0x05 LDB 0x21
0x06 ADDA 0x22
0x07 DECB
0x08 JNZB 0x06
0x09 STA 0x20

```

14. After the processor executes the instruction in line 0x09, what are the contents of memory address 0x20?

- A. An infinite loop occurs and the processor never reaches the instruction at 0x09
- B. 0x37
- C. 0x0A
- D. 0x2A
- E. 0x20

15. After the processor executes the instruction in line 0x09, what is stored in memory location 0x21?

- A. 0x00
- B. 0x01
- C. 0x37
- D. 0x0A
- E. 0x05

16. If the instruction at memory location 0x08 were changed to NOP, what would be stored in memory location 0x20 after the execution of the instruction on line 0x09 ?
- A. 0x00
 - B. 0x02
 - C. 0x05
 - D. 0x21
 - E. An infinite loop occurs and the processor never reaches the instruction at 0x09

Use the following code for questions 17 through 19:

```
1  #include <iostream >
2  using namespace std;
3
4  int main()
5  {
6  int a = 10;
7  int b = 0;
8
9  do {
10 b += a;
11 } while(--a % 7 && b);
12
13 cout << b << a << endl;
14 return 0;
15 }
```

17. What will be printed to standard output?

- A. 277
- B. 727
- C. 010
- D. 346
- E. 198

18. What is the && in the while conditional?

- A. Bitwise AND operator
- B. Logical AND operator
- C. Postfix increment operator
- D. Prefix increment operator
- E. Logical pointer dereferencing operator

19. How many times does the while conditional execute?

- A. 70
- B. 10
- C. 3
- D. Infinite
- E. 11

20. A template function is an example of which of the following?

- A. Inheritance
- B. Friend method
- C. Operator overloading
- D. Overloadable method
- E. Polymorphism

Use the following code for questions 21 through 23:

```
1 #include <iostream >
2 using namespace std;
3
4 #define CHECK(x,y) (x % y)
5
6 int main()
7 {
8 int a = 4;
9 int b = 3;
10
11 #ifdef a
12 a += b;
13 #endif
14
15 for (int i = 0; i < CHECK(a, b); i++)
16 {
17 cout << b << endl;
18 }
19
20 return 0;
21 }
```

21. What is CHECK?

- A. Preprocessor directive
- B. Predefined function
- C. Constant function
- D. Macro
- E. Both A and D

22. How many times does the cout statement get executed?
- A.0
 - B.1
 - C.3
 - D.4
 - E.5
23. If #define a 1 were added immediately before int main, how many times would the cout statement be executed?
- A.1
 - B.7
 - C. The code does not compile
 - D. Infinite loop
 - E.3
24. A best-practice when implementing a modern RESTful Web API is to utilize HTTPS. Which of the following explains the benefits of this?
- A. HTTPS increases the speed of accessing web services
 - B. HTTPS provides a method of preventing data-tampering at-rest
 - C. HTTPS provides a method of preventing data-tampering in-transit
 - D. Both A and C
 - E. Both A and B
25. Which of the following is an example of a TLD (top-level domain)?
- A. example
 - B. example.com
 - C. example.com. 3600 IN MX 10 mx01.example.com.
 - D. edu
 - E. . (dot)
26. What is logically equivalent to the following expression if Z is true?

$$(X \wedge \neg Y \wedge \neg Z) \vee (Y \wedge Z) \vee (Z \wedge \neg Z)$$

- A. $(X \wedge \neg Y) \vee Y \vee \text{true}$
- B. $Y \vee \text{false}$
- C. Y
- D. true
- E. Both B and C

27. A given algorithm takes $2 \cdot x^2 + x + 4 + 6 \cdot x^2$ steps to complete. The time it takes for this algorithm to complete can be rewritten as which of the following?

- A. $\theta(x)$
- B. $O(x^2)$
- C. $\theta(8x^2)$
- D. $\theta(x^2)$
- E. Both B and D

Use the following code for questions 28 through 30:

```

1 #include <iostream >
2 using namespace std;
3
4 int i;
5 void fun(unsigned int a)
6 {
7 for(i = 0; i < a; i++)
8 {
9 for(int j = i; j < --a; j++)
10 {
11 cout << "Hi";
12 }
13 }
14 cout << endl;
15 }
16
17 int main()
18 {
19 fun(3);
20
21 return 0;
22 }

```

28. What is printed to standard output?

- A. *Nothing*
- B. The word "Hi" printed 6 times
- C. The word "Hi" printed 3 times
- D. The word "Hi" printed 1 time
- E. *Infinite loop or does not compile*

29. What scope is variable i defined in?

- A. Global Address Scope
- B. Function Scope
- C. Global Scope
- D. On the stack
- E. On the heap

30. If the call `fun(3)` were changed to call `fun(-3)`, what would happen?
- A. Compile-time exception, since `-3` cannot be assigned to an unsigned int parameter.
 - B. Compile-time exception, since `-3` would cause an infinite loop
 - C. Runtime exception, since `-3` cannot be assigned to an unsigned int parameter
 - D. The output of the program would remain unchanged, since `-3` would be type-casted from an int to an unsigned int, resulting in a being set to 3
 - E. None of the above

SCRATCH PAPER

