American Computer Science League

2019-2020 **ACSL Finals**

Elementary Shorts

1. Boolean Algebra

Determine which comparison symbol(s) could be used for the ? for the following expression to be TRUE.

NOT (10 - 3 ^ 2 ≤ 1) OR (56 / 8 - 1 ? 7 AND 4 + 5 * 2 > 13)

A. =
B. <
C. >
D. ≥
E. None of the above

2. Boolean Algebra

Simplify the following Boolean expression using the given symbols:

~(A + ~B) * ~AB + ~(A~B)

A. 1
B. ~A+B
C. ~AB
D. A+~B
E. None of the above

3. Boolean Algebra

Define a new binary operator, $, as follows:

A $ B = ~AB

It has higher precedence than the AND operator.

How many ordered pairs make the following TRUE?

A $ B + (~A $ B) (~A $ ~B)

A. 1
B. 2
C. 3
D. 4
E. None of the above

4. Prefix-Infix-Postfix

Evaluate the following postfix expression:

2 3 2 ^ * 4 - 8 4 / / 5 2 * 2 + 2 / *

A. 13
B. 42
C. 60
D. 96
E. None of the above

5. Prefix-Infix-Postfix

Evaluate the following prefix expression if all numbers are single digits:

+ / * 4 + 2 7 ^ 6 2 * ^ + 1 4 2 2

A. 21
B. 86
C. 50
D. 51
E. None of the above

6. Prefix-Infix-Postfix

Define: a $ b = minimum of {a,b}

a # b = maximum of {a,b}

Evaluate this prefix expression if all numbers are single digits:

/ # * - ^ 3 2 4 7 ^ 6 $ 2 8 4

A. 7
B. 9
C. 11
D. 13
E. None of the above

7. Computer Number Systems

Evaluate and express the result in hexadecimal:

$$2020_8 - 202_8 - 20_8 + 2_8$$

A. F00
B. 700
C. 380
D. 3A0
E. None of the above

8. Computer Number Systems

How many 1's are there in the binary representations of the decimal numbers 16 to 32 inclusive?

A. 48
B. 49
C. 50
D. 52
E. None of the above

9. Computer Number Systems

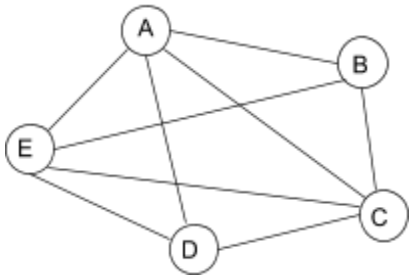
Which of the following has the smallest value in base 10?

a. $4A_{16}$ b. 1001001_2 c. 112_8 d. 49_{16} e. 110_8

A. $4A_{16}$
B. 1001001_2
C. 112_8
D. 49_{16}
E. 110_8

10. Graph Theory

Determine if the graph is traversable. Your answer should be NO, YES if any pair of vertices could work, or the only possible starting and ending vertex in alphabetical order (e.g. AB, not BA).



A. NO
B. AE
C. BD
D. YES
E. None of the above

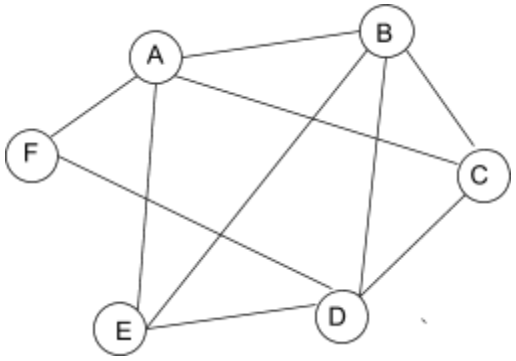
11. Graph Theory

How many cycles are there in the graph represented by the graph defined by vertices {A,B,C,D} and edges {AB,BD,CA,DC}?

A. 0
B. 2
C. 4
D. 8
E. None of the above

12. Graph Theory

Determine the number of simple paths that exist from vertex A to vertex D.



A. 7
B. 8
C. 9
D. 10
E. None of the above