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

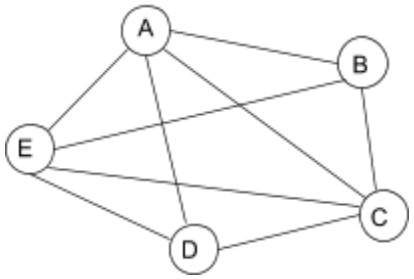
Which of the following has the smallest value in base 10?

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

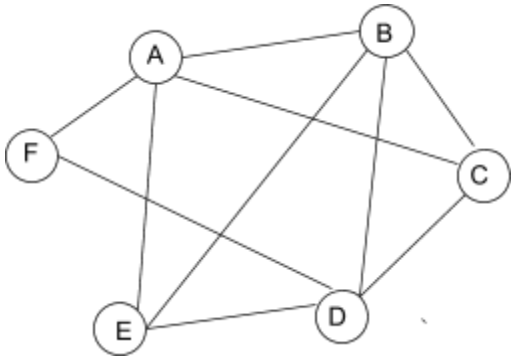
11. Graph Theory

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

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2019-2020 **ACSL Finals**

Elementary Shorts

1. Boolean Algebra 给下面表达式中的? 选择一个比较运算符（右侧选项）使得下列表达式最终为真? **NOT (10 - 3 ^ 2 ≤ 1) OR (56 / 8 - 1 ? 7 AND 4 + 5 * 2 > 13)**	A. = B. < C. > D. ≥ E. 以上均不是正确答案
2. Boolean Algebra 使用给定的符号简化以下布尔表达式: **~(A + ~B) * ~AB + ~(A~B)**	A. 1 B. ~A+B C. ~AB D. A+~B E. 以上均不是正确答案
3. Boolean Algebra 定义一个新的二进制运算符, $, 如下所示: A $ B = ~AB 其优先级高于AND 运算符。 有多少个有序对能使下述表达式为真? **A $ B + (~A $ B) (~A $ ~B)**	A. 1 B. 2 C. 3 D. 4 E. 以上均不是正确答案
4. Prefix-Infix-Postfix 计算下述后缀表达式的值: **2 3 2 ^ * 4 - 8 4 / / 5 2 * 2 + 2 / ***	A. 13 B. 42 C. 60 D. 96 E. 以上均不是正确答案

5. Prefix-Infix-Postfix

所有数字都是单个数字，请计算此前缀表达式的值：

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

A. 21
B. 86
C. 50
D. 51
E. 以上均不是正确答案

6. Prefix-Infix-Postfix

定义：　a $ b = {a,b}的最小值
　　a # b = {a,b}的最大值

若所有数字都是单个数字，请计算此前缀表达式的值：

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

A. 7
B. 9
C. 11
D. 13
E. 以上均不是正确答案

7. Computer Number Systems

计算下述算式的值，并以十六进制表示其结果：

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

A. F00
B. 700
C. 380
D. 3A0
E. 以上均不是正确答案

8. Computer Number Systems

从16到32（包括16和32）的十进制数在二进制表示下一共有多少个1?

A. 48
B. 49
C. 50
D. 52
E. 以上均不是正确答案

9. Computer Number Systems

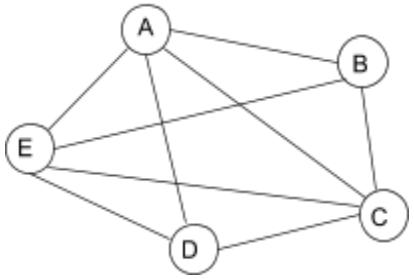
在十进制下，以下哪个选项的值最小?

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

判断下面的图是否可以遍历。你的回答应该是NO或者YES。如果任何一对顶点都能够作为开始结点和结束顶点来遍历图，那么你的回答是YES。若仅仅只有一对开始顶点和结束顶点可以遍历图，那么按照字母顺序写出这唯一的结果（例如 AB，不是BA）。



A. NO
B. AE
C. BD
D. YES
E. 以上均不是正确答案

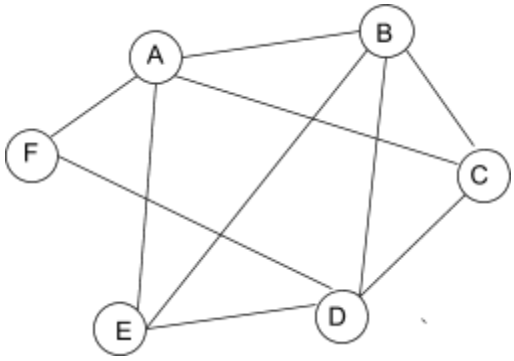
11. Graph Theory

由顶点{A，B，C，D}和边{AB，BD，CA，DC}定义的图中有多少个环?

A. 0
B. 2
C. 4
D. 8
E. 以上均不是正确答案

12. Graph Theory

确定从顶点A到顶点D的简单路径的数量。



A. 7
B. 8
C. 9
D. 10
E. 以上均不是正确答案