ACSL

2010 - 2011 **American Computer Science League** **All-Star**

Short Round Questions

1. Boolean Algebra

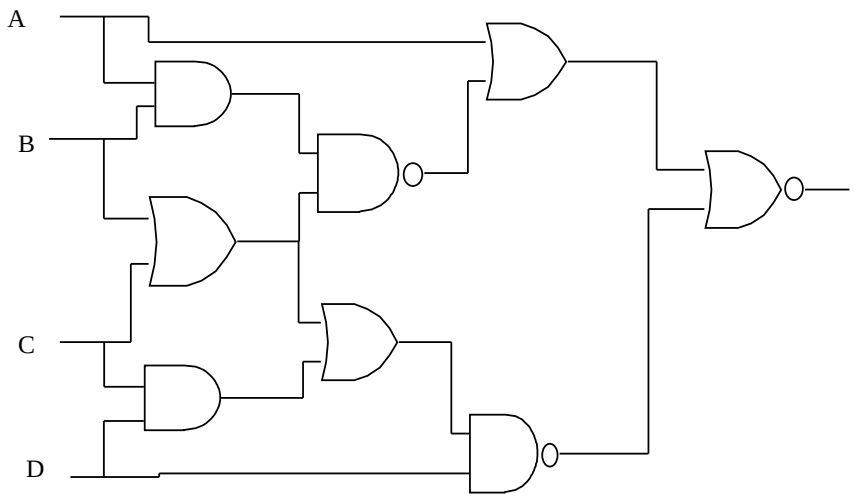
Simplify the following Boolean expression:

$$\overline{(A\overline{B}+C)(\overline{B+\overline{C}})+\overline{A}(\overline{B}+\overline{C})}$$

A. $\overline{A}$
B. $\overline{C}$
C. $\overline{A}\,\overline{C}$
D. $\overline{AC}$
E. None of the above

2. Digital Electronics

How many ordered quadruples make the following circuit TRUE?



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

3. Prefix-Infix-Postfix

Define: a ∇ b = average of a and b a √ b = square root of a*b
a◊b = greater of a and b a □ b = $(a+b)^2$

Evaluate the following postfix expression:

3 7 * 3 1 ↑ ∇ 3 2 ◊ 2 4 ◊ * 9 3 / √ ∇ 8 4 / 7 6 - □ ∇

A. 2
B. 6
C. 9
D. 18
E. None of the above

4. Computer Number Systems

How many different 1-byte values contain the bit string 00100?

A. 8
B. 24
C. 31
D. 32
E. None of the above

5. Bit-String Flicking

Which value(s) of X (five bits long) solve the following equation?

RSHIFT-2 (LCIRC-2 X) OR LSHIFT-2 00101 AND (NOT 01110) = RCIRC-2(LSHIFT-1 01101) OR X

A. *001*
B. *101*
C. *011*
D. *0*1*
E. None of the above

6. What Does This Program Do?

What is the smallest value of **X** that would cause the following program to print out at least 10 different numbers?

```
for J = 1 to X
      for K = J to X
        print K  +  J
   next K
next J
```

A. 3
B. 4
C. 5
D. 8
E. None of the above

7. Recursive Functions

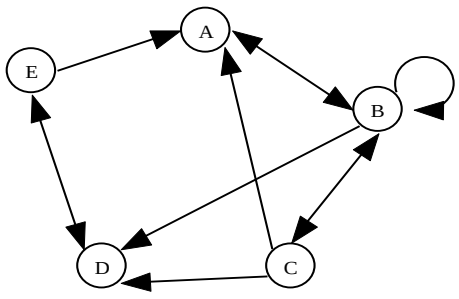
Find $f(5,11)$,given:

$$f(x,y) = \begin{cases} f(x+2, y-1) + 2 & \text{if } x < y \\ f(f(x+1, y-1), 1) - 3 & \text{if } x = y \\ x + 2 - y & \text{if } x > y \end{cases}$$

A. 2
B. 4
C. 6
D. 8
E. None of the above

8. Graph Theory

In the directed graph on the right, how many paths are there of length 3 that end at **B**?



A. 15
B. 21
C. 33
D. 36
E. None of the above

9. Data Structures

What is the internal path length of the binary search tree for the following expression?

C O N S T I T U T I O N S T A T E

A. 42
B. 45
C. 55
D. 58
E. None of the above

10. LISP

(SETQ X '(((a (b c) d) e)((b (c (d e) b)) a)(a b c)((e d) b (a b)(c e d))))

Evaluate the following expression:

(CDR(CDR(CDR(REVERSE(CAR(REVERSE(CDR X)))))))

A. (e d)
B. (b(e d))
C. ((e d)b)
D. ((e d))
E. None of the above

11. FSA and Regular Expressions

Which of the strings below are represented by the following regular expression?

01*0(01*10*(01*00*1 U 10*1) U 11*001*0)

a) 0001101001 b) 01110001011 c) 010101010
d) 0100000 e) 011001011 f) 01010010

A. a, b, e
B. a, c, f
C. a, e, f
D. a, c, d, f
E. None of the above

12. Assembly Language

What is the final value of A when the program is run?

```
A     DC     5
B     DC     9
C     DC     0
N     DC     100
TOP   LOAD   A
      ADD    B
      STORE  C
      LOAD   B
      STORE  A
      LOAD   C
      STORE  B
      SUB    N
      BL     TOP
      END
```

A. 60
B. 97
C. 134
D. 157
E. None of the above