Short Round Questions

1. Boolean Algebra

Simplify the following Boolean expression:

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

A. 0
B. $A\overline{C}+\overline{B}$
C. $A+\overline{B}C$
D. 1
E. None of the above

2. Digital Electronics

Let □ be a gate with 3 inputs that is true if exactly 2 inputs are the same. Let ◊ be a gate with 3 inputs that is true if at least 1 input is true. How many ordered quadruples make the following circuit true?
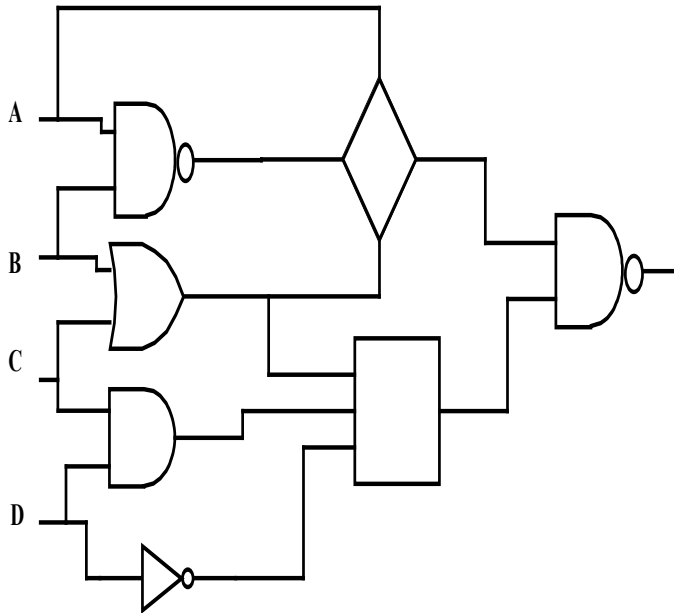
A. 0
B. 2
C. 4
D. 8
E. None of the above

3. Prefix-Infix-Postfix

Define: **a # b** = (a+b)/2
     a % b = [a/b] = greatest integer ≤ a/b
     a& = √a = principal square root of a
Evaluate the following prefix expression: (all single digits)

- + % 9 2 * & 9 ↑ + / # 9 7 4 & 4 2 / / * / * 9 # 7 5 % 7 2 8 & + 9 7 & 4

A. 21
B. 52
C. 34
D. 56
E. None of the above

4. Computer Number Systems

  Which term is next (expressed in octal) in the sequence below?

$$11_2 \quad 11_8 \quad 110111_2 \quad 51_{16} \quad ?_8$$

A. 213
B. 243
C. 323
D. 363
E. None of the above

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5. Bit-String Flicking

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

(LCIRC – 2 (01011 OR X)) AND (RSHIFT – 2 (10111 AND X)) =
(RCIRC – 2 (LSHIFT – 1 X))

A. 11010, 10010
B. 10101, 10001
C. 11000, 00000
D. 10100, 11100
E. None of the above

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6. What Does This Program Do?

  What is the output after this program is executed?

```
c = 99
for i = 2 to 99 step 2
   c = c - 1
next i
for j = 3 to 99 step 6
     if j/5 = int(j/5) then c = c – 1
next j
for k = 5 to 99 step 10
       if k = 5 then c = c – 1
       if (k/3 <> int(k/3)) and (k<>5) then c = c – 1
next k
print c
end
```

A. 36
B. 39
C. 41
D. 49
E. None of the above

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7. Recursive Functions

  Find $f(13,1)$ given:

$$f(x,y) = \begin{cases} f(x-1, y+3)+3 & \text{if } x > y \\ x + f(x+4, y-2) & \text{if } x = y \\ 2x + 3y & \text{if } x < y \end{cases}$$
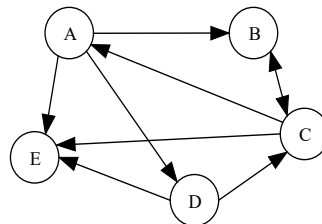
A. 75
B. 91
C. 88
D. 94
E. None of the above

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8. Data Structures

  Given a heap of depth six and with the bottom level completely filled, what is its internal path length?

A. 384
B. 642
C. 896
D. 1538
E. None of the above

9. Graph Theory

Adding which directed edge to the original graph will increase the number of cycles from A by the smallest number?

A. EB
B. EA
C. EC
D. ED
E. BA

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10. LISP

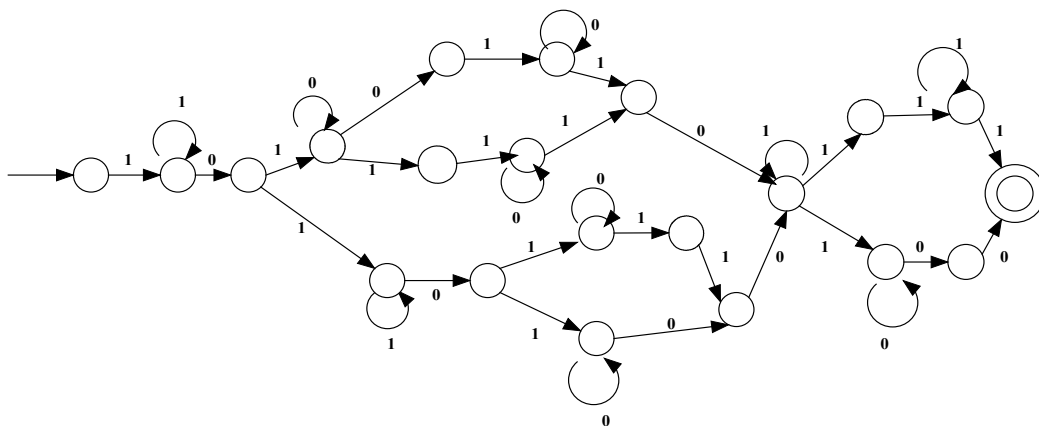(SETQ X '(1(2 (3 4)) (5 (6 7) 8 (9 (1 4)))))

Evaluate the following expression:

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

A. (6 7)
B. (5)
C. (5 (6 7))
D. (1 4)
E. None of the above

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11. FSA and Regular Expressions

Which of the strings below are represented by the following FSA?

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

a. 1010100111
b. 11010110100101
c. 101001100101111111
d. 1101101011011100
e. 1010100011010
f. 110100010001011111000000000

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12. Assembly Language

After the following program is executed, what is printed? The data for the program is 1, -1, 2, -2, 3, -3, 4, -4, 5, -5, 0.

```
TOP     READ   N                    SUB     =30
        BE     DONE                 BE      ANS
        LOAD   N                    BU      TOP
        MULT   N            ANS     PRINT  N
        MULT   =2                   BU      TOP
        STORE  TEMP1         DONE    END
        LOAD   N
        MULT   =4
        STORE  TEMP2
        LOAD   TEMP1
        SUB    TEMP2
```

A. 5, -1
B. -3, 2
C. -3, 5
D. 4, 5
E. None of the above