Short Round Questions

1. Boolean Algebra

How many ordered quadruples make the following Boolean expression FALSE?

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

A. 0
B. 1
C. 5
D. 9
E. None of the above

2. Bit-String Flicking

How many different values of X (a bitstring of 5 bits) make the following equation TRUE? Let X = abcde and NOT X = ABCDE.

(LSHIFT-1 (LCIRC-2 01010)) OR
(LCIRC-2 (NOT (LCIRC-2(X OR 01100)))) = 1BC1E

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

3. Recursive Functions

Find $f(20,2)$ given :

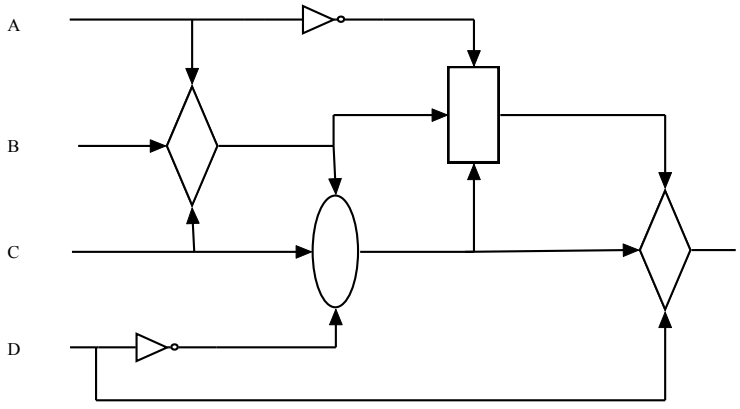
$$f(x,y) = \begin{cases} f(2y,\ x\ -\ 3)\ -\ 1 & if\ x > y \\ f(\ \lfloor y/2 \rfloor, x\ -\ 1) + 3 & if\ x < y \\ 4 & if\ x = y \end{cases}$$

Note : $\lfloor x \rfloor$ represents the greatest integer less than or equal to x

A. 6
B. 7
C. 9
D. 10
E. None of the above

4. Digital Electronics

Define the following new gates: A *diamond* has 3 inputs and is TRUE if only 1 input is TRUE, an *oval* has 3 inputs and is TRUE if at most 1 input is TRUE, and a *rectangle* has 3 inputs and is TRUE if all inputs are TRUE. How many ordered quadruples make the following circuit TRUE?



A. 1
B. 3
C. 9
D. 13
E. None of the above

5. Prefix-Infix-Postfix

Define a # b = $a^2 - ab + b^2$
Evaluate this prefix expression. Note: all numbers are single digits.

+ − / * 3 # # 0 2 2 * 2 3 / # 4 − 8 6 * 3 2 ↑ 2 4

A. 15
B. 20
C. 38
D. 56
E. None of the above

6. Computer Number Systems

How many numbers from 200 to 400 in base 10 consist of distinct ascending digits and also have distinct ascending hex digits when converted to base 16?

A. 6
B. 8
C. 10
D. 12
E. None of the above

7. What Does This Program Do?

What value is output when the following program is executed?

```
for x = 0 to 4
   for y = 0 to 4
      A(x,y) = (x+1) ^ 2 + y
   next y
next x
for x = 0 to 4
   for y = 0 to 4
      if A(x,y) % 3 == 0 then
         A(x,y) = A(x,y) / 3
      if A(x,y) % 4 == 0 then
         A(x,y) = A(x,y) / 4
      if A(x,y) % 5 == 0 then
         A(x,y) = A(x,y) / 5
   next y
next x
s = 0
for x = 0 to 4
   for y = 0 to 4
      if A(x,y) % 2 == 0 then
         s = s + A(x,y)
    next y
next x
output s
```

A. 7
B. 20
C. 48
D. 58
E. None of the above

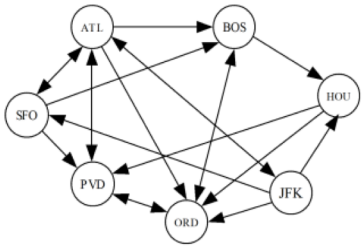
8. Data Structures

Consider all binary search trees with 16 nodes. What is the smallest value for the internal path length?

A. 34
B. 38
C. 42
D. 44
E. None of the above

9. Graph Theory

Given the following directed graph of airports and the flights available among them, how many flights from ATL to ORD have only 1 intermediate stop?



A. 1
B. 3
C. 4
D. 9
E. None of the above

10. LISP

Evaluate the following sequence of Lisp functions:

```
(SETQ U '((a (b c)) (d e f) (g) (h (i j k)) (l m) n))
(SETQ V '(p (q r) (s (t u v)) (w (x y) z)))
(SETQ X (CDR (CAR (CDR (CDR V)))))
(SETQ Y (CAR (CDR (CAR (CDR (CDR (CDR U)))))))
(REVERSE (CONS Y X))
```

A. ((t u v) (i j k))
B. (t u v (i j k))
C. (t u v i j k)
D. ((t u v) i j k)
E. None of the above

11. FSAs and Regular Expressions

List all of the strings that are accepted by the regular expression

((0 1)* (11 00) 1*100*)*

a. 0001111101
b. 11111111111111
c. λ
d. 0101010101010101
e. 001011101111111110
f. 000010000000000000
g. 1111111111111011110

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

12. Assembly Language

What is the final value printed when this program is executed?

```
        NUM     DC      24          STORE   NUM
        CNT     DC      0           BU      START
START   LOAD    NUM         CONT    LOAD    NUM
        SUB     =1                  DIV     =2
        BE      DONE                STORE   NUM
        LOAD    CNT                 BU      START
        ADD     =1          DONE    PRINT   CNT
        STORE   CNT                 END
        LOAD    NUM
        DIV     =2
        MULT    =2
        SUB     NUM
        BE      CONT
        LOAD    NUM
        MULT    =3
        ADD     =1
```

A. 8
B. 10
C. 12
D. 16
E. None of the above