American Computer Science League

1. Computer Number Systems

How many 1's are there in the binary representation of 2021_{10} ?

A. 6
B. 7
C. 8
D. 9
E. 10

2. Computer Number Systems

Evaluate and express the answer in hexadecimal:

$72126_8 - 54127_8$

A. $1BFF_{16}$
B. $1AEF_{16}$
C. $1BFE_{16}$
D. $1AFF_{16}$
E. BFF_{16}

3. Recursive Functions

Find $f(10)$, given:

$$f(x) = \begin{cases} 2x+2 & if\ x \leq 2 \\ f(x-1) - f(x-2) & if\ x > 2 \end{cases}$$

A. -6
B. -4
C. 2
D. 4
E. 6

4. Recursive Functions

Find $f(f(17))$, given:

$$f(x) = \begin{cases} 2+f(x-2) & if\ x \geq 8 \\ x-4 & if\ x < 8 \end{cases}$$

A. 9
B. 11
C. 13
D. 15
E. 1

5. What Does This Program Do? (Branching)

How many different unique values do the variables a, b, c, and d take on when this program is executed?

```
a = 5 : b = 2 : c = 25 : d = 4
if c / a > d then
      b = b + d
else
      b = b + c / a
end if
c = c − a * b / 2
if (b < c) && (d < a) then
      d = d / 4
else
      a = c ^ 2 / a
end if
if d % a == 0 then
      d = b + c
end if
if (c /2 > b) || ( b − d == a) then
      d = 5 * d
end if
```

A. 4
B. 5
C. 6
D. 7
E. 8