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:

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

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

4. Recursive Functions

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

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

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

1. Computer Number Systems

用二进制表示十进制数 2021_{10}，共会出现多少个数字 1?

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

2. Computer Number Systems

计算并将结果用十六进制表示:

$72126_8 - 54127_8$

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

3. Recursive Functions

根据以下条件求 $f(10)$

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

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

4. Recursive Functions

根据以下条件求 $f(f(17))$

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

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

5. What Does This Program Do? (Branching)

执行以下程序，变量 a, b, c, d 共被赋予多少个不同的唯一值?

```
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