ACSL

2016 - 2017 **American Computer Science League** **Contest #1**

Senior Division

1. Recursive Functions

Find $f(28)$, given:

$$f(x) = \begin{cases} f(x/2)+1 & \text{if } x \geq 6 \text{ and even} \\ f([x/2])-3 & \text{if } x \geq 1 \text{ and odd} \\ 3x+4 & \text{otherwise} \end{cases}$$

Note: [a] returns the greatest integer less than or equal to a

2. Recursive Functions

Find $f(20,10)$, given:

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

3. Computer Number Systems

Which one has the most 1's in the answer of each expressed in binary?

A. $A_{16} + 1011_2 + 73_8$ B. $23_8 + F_{16} - 111_2 + 11_8$

C. $2A_{16} + 75_8 - 31_{10}$ D. $F_{16} - 1E_{16} + 67_8 - 35_8$

4. Computer Number Systems

A number is a palindrome if its digits read the same forward or backwards. This year, 2016, is not a palindrome in hex or octal. What is the positive difference in decimal years when the next hex and octal conversions will each be palindromes?

5. What Does This Program Do?

After the following program is executed, what is printed?

```
a = 20: b = 4: c = 2: d = 100: e = 3
for i = 1 to 4
    if a / i > d / b then a = a - 2 else d = d - 20
    if b + 3 * i < a * c then b = b + 1 else c = c + 1
    if c ^ e > e ^ c then c = c + 1 else e = e + 1
next i
print 4 * (a / e + b / c) – a / (b + 2) + d ^ 2 / a * 2
end
```