American Computer Science League

2018-2019 **Contest #1**

INTERMEDIATE DIVISION

个人考号/Exam Code: _____ 姓名/Name: _____ 学校/School: _____

1. Computer Number Systems **1.**

Convert $23A4B_{16}$ to octal.

2. Computer Number Systems **2.**

How many decimal numbers from 1 to 32 have more 1's than 0's in their binary representation? Note: ignore leading zeroes.

3. Recursive Functions **3.**

Find $f(20)$ given: $f(x) = \begin{cases} f(f(x-2))+1 & \text{if } x \geq 16 \\ f([x/2])-1 & \text{if } 8 \leq x < 16 \\ [x/2] & \text{if } x < 8 \end{cases}$

Note: [x] is the greatest integer $\leq$ x

4. Recursive Functions **4.**

Find $f(7)$ given: $\begin{cases} f(1) = 2 \\ f(2) = -2 \\ f(n) = 2 * f(n-1) + 3 * f(n-2) - 1 \end{cases}$

5.

5. What Does This Program Do?

What is output when this program is executed?

```
a = 10 : b = 2 : c = 40
d = a / b
e = 6 * a + c
f = b * c / d
if d < e then
    d = d + d
else
    e = e + e
end if
if a * d > e then
    a = a * d
else
    e = e − a * d
end if
if c ↑ e == b ↑ e  then
    c = c / 2
else
    b = b * b
end if
if (f < c) && (a > b) then
    f = f / 4
else
    a = a / b
end if
if 2 * d − 3 * b == c + a then
    d = b + c
end if
f = f / 2
g = a * b + c + d + e + f * a
h = g / (c − a) + b * ( c ↑ e + f ) / 3 − b ↑ a / f ↑ 5 / b
output h
end
```

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1. Computer Number Systems **1.**

将 $23A4B_{16}$ 转换为八进制。

2. Computer Number Systems **2.**

从 1 到 32（十进制下）中，有多少个数在二进制表示下 1 的数量多于 0 的数量？ 注：忽略前导零。

3. Recursive Functions **3.**

计算$f(20)$：

$$f(x) = \begin{cases} f(f(x-2)) + 1 & if\ x \geq 16 \\ f\left(\left[\frac{x}{2}\right]\right) - 1 & if\ 8 \leq x < 16 \\ \left[\frac{x}{2}\right] & if\ x < 8 \end{cases}$$

注： [x]是不超过 x 的最大整数

4. Recursive Functions **4.**

计算$f(7)$：

$$\begin{cases} f(1) = 2 \\ f(2) = -2 \\ f(n) = 2 * f(n-1) + 3 * f(n-2) - 1 \end{cases}$$

5. What Does This Program Do?

执行这个程序时，输出值是什么？

```
a = 10 : b = 2 : c = 40
d = a / b
e = 6 * a + c
f = b * c / d
if d < e then
    d = d + d
else
    e = e + e
end if
if a * d > e then
    a = a * d
else
    e = e − a * d
end if
if c ↑ e == b ↑ e then
    c = c / 2
else
    b = b * b
end if
if (f < c) && (a > b) then
    f = f / 4
else
    a = a / b
end if
if 2 * d − 3 * b == c + a then
    d = b + c
end if
f = f / 2
g = a * b + c + d + e + f * a
h = g / (c − a) + b * ( c ↑ e + f ) / 3 − b ↑ a / f ↑ 5 / b
output h
end
```

5.