American Computer Science League

JUNIOR DIVISION

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

1. Computer Number Systems Convert 2018_{10} to octal.	**1.**
2. Computer Number Systems How many decimal numbers from 1 to 32 have the same number of 1's and 0's in their binary representation? Note: ignore leading zeroes.	**2.**
3. Recursive Functions Find $f(18)$ given: $$f(x) = \begin{cases} f(x-5)+1 & \text{if } x > 5 \\ 7 & \text{if } x = 5 \\ f(x+3)-2 & \text{if } x < 5 \end{cases}$$	**3.**
4. Recursive Functions Find $f(f(f(f(24))))$ given: $$f(x) = \begin{cases} [x/2]+1 & \text{if } x \text{ is even} \\ [x/3]-2 & \text{if } x \text{ is odd} \end{cases}$$ Note: [x] is the greatest integer $\leq$ x	**4.**

5. What Does This Program Do? - Branching

5.

What is output when this program is executed?

```
a = 2 : b = 1 : c = 0 : d = 3 : e = 4
f = a + b + c + d + e
if f / 5 == a then
    f = f / 5
else
    f = a + 2
end if
if a + b < d * e / 2 then
    b  = d
else
    a = e
end if
 if 2 * d ↑ c == e / a then
    d = e
else
    c = a
end if
if (b < d) && (c < e) then
    b = d
else
    c = e
end if
 if (c ↑ a > d * e) || (f < d / e) then
    c = a
else
    d = c
end if
output  2 * a + b * (c – d) + e / 2 * f
end
```

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

1. Computer Number Systems 将 2018_{10} 转换成八进制。	**1.**
2. Computer Number Systems 从 1 到 32（十进制下）中，有多少个数在二进制表示下有相同数量的 0 和 1？ 注：忽略前导零。	**2.**
3. Recursive Functions 计算 $f(18)$： $$f(x) = \begin{cases} f(x-5)+1 & if\ x > 5 \\ 7 & if\ x = 5 \\ f(x+3)-2 & if\ x < 5 \end{cases}$$	**3.**
4. Recursive Functions 计算 $f(f(f(24)))$： $$f(x) = \begin{cases} \left[\frac{x}{2}\right] + 1 & if\ x\ 是偶数 \\ \left[\frac{x}{3}\right] - 2 & if\ x\ 是奇数 \end{cases}$$ 注： $[x]$ 是不超过 x 的最大整数	**4.**

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5. What Does This Program Do? - Branching

5.

执行这个程序时，输出值是什么？

```
a = 2 : b = 1 : c = 0 : d = 3 : e = 4
f = a + b + c + d + e
if f / 5 == a then
    f = f / 5
else
    f = a + 2
end if
if a + b < d * e / 2 then
    b  = d
else
    a = e
end if
 if 2 * d ↑ c == e / a then
    d = e
else
    c = a
end if
if (b < d) && (c < e) then
    b = d
else
    c = e
end if
 if (c ↑ a > d * e) || (f < d / e) then
    c = a
else
    d = c
end if
output 2 * a + b * (c – d) + e / 2 * f
end
```