American Computer Science League

2018-2019 **Contest #1**

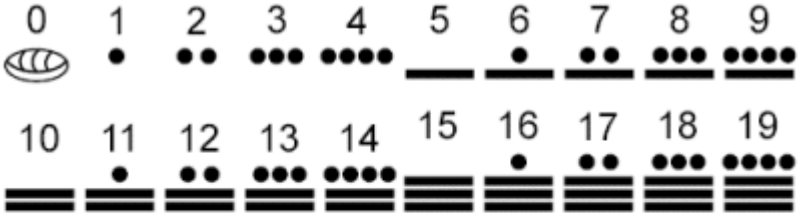
SENIOR DIVISION

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

1. Computer Number Systems **1.**

Convert 4267_8 to its Mayan representation.

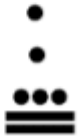
The ancient Mayan numbering system (vigesimal) is base 20.



Example:

28 = (1 x 20) + 8 =

433 = (1 x 400) + (1 x 20) + 13 =



2. Computer Number Systems **2.**

How many decimal numbers from 1 to 64 have fewer 1's than 0's in their binary representation? Note: ignore leading zeroes.

3. Recursive Functions **3.**

Find $f(6,16)$ given:

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

4. Recursive Functions | **4.**

From ground level a ball is shot vertically up into the air and reaches a height of 128 feet. When it comes back down and bounces, it only reaches one half of the previous height on each subsequent bounce. How many times will it bounce to travel a total of 500 feet?

5. What Does This Program Do? | **5.**

What is output when this program is executed?

```
a = 100 : b = a / 5 : c = a / b
d = a / (b + c) : e = b / c
if a == b * c then
    f = 2
end if
if d / 3 == int(d / 3) then
    d = d / 3
else
    d = d + 1
end if
if d * e – b < e then
    a = a / f
else
    a = a / (b + c)
end if
if (a > b) || (c < d) then
    a = a – d * e
end if
if (a == c * d) && (b – d == e * a) then
    b = b – e * f
else
    b = b / d / e
end if
g = f ↑ c / e – e * f + b ↑ (a + 2 * d) * c * e / (d * e)
output g
end
```