

American Computer Science League

2020-2021 • Contest 1: Shorts • Junior Division

1. Computer Number Systems How many 1's are there in the binary representation of the decimal numbers from 22 to 32, inclusive?	A. 34 B. 35 C. 36 D. 37 E. 38
2. Computer Number Systems Which number is the largest? 101100000_2 535_8 $15F_{16}$	A. 101100000_2 B. 535_8 C. $15F_{16}$ D. 2 of them are the largest E. all 3 are the same
3. Recursive Functions Find $f(7)$, given: $f(x) = \begin{cases} 1 & \text{if } x = 1 \\ x + f(x - 1) & \text{if } x > 1 \end{cases}$	A. 27 B. 28 C. 30 D. 36 E. 38

4. Recursive Functions

Find $f(20)$, given:

$$f(x) = \begin{cases} f\left(\frac{x}{2}\right) + 1 & \text{if } x \text{ is even} \\ f(x+3) - 1 & \text{if } x \text{ is odd and } x > 3 \\ \frac{x+1}{2} & \text{otherwise} \end{cases}$$

- A. 2
- B. 3
- C. 4
- D. 5
- E. 6

5. What Does This Program Do? (Branching)

What is the output when this program is executed?

```
a = 24 : b = 2 : c = 3
if a / c == b ^ c then
    b = b * c
end if
if c + a / b > b then
    a = a - b * c
end if
b = b + a / 3
if b > a + c then
    b = 2 * b
else
    c = a / c
end if
output a + b / c ^ 2.
```

- A. 8
 - B. 10
 - C. 22
 - D. 28
 - E. 49
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