

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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1. Computer Number Systems 把十进制数 22 到 32（包含 22 和 32）用二进制表示，共会出现多少个数字 1？	A. 34 B. 35 C. 36 D. 37 E. 38
2. Computer Number Systems 下列哪个数最大？ 101100000_2 535_8 $15F_{16}$	A. 101100000_2 B. 535_8 C. $15F_{16}$ D. 其中有 2 个数最大 E. 3 个数一样大
3. Recursive Functions 根据以下条件，求 $f(7)$ ： $f(x) = \begin{cases} 1 & \text{当 } x = 1 \text{ 时} \\ x + f(x - 1) & \text{当 } x > 1 \text{ 时} \end{cases}$	A. 27 B. 28 C. 30 D. 36 E. 38

4. Recursive Functions

根据以下条件，求 $f(20)$:

$$f(x) = \begin{cases} f\left(\frac{x}{2}\right) + 1 & \text{当 } x \text{ 为偶数时} \\ f(x+3) - 1 & \text{当 } x \text{ 为奇数, 且 } x > 3 \text{ 时} \\ \frac{x+1}{2} & \text{上述条件均不符合时} \end{cases}$$

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

5. What Does This Program Do? (Branching)

执行以下程序，输出值是多少？

```
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