

# American Computer Science League

2021-2022 • Contest 1: Short Problems • Junior Division

<b>1. Computer Number Systems</b>  Convert $2122_{10}$ to octal.	A. 4211 B. 4121 C. 1224 D. 4112 E. 2114
<b>2. Computer Number Systems</b>  The Fibonacci sequence $\{0, 1, 1, 2, 3, 5, 8, 13, \dots\}$ is formed by adding the two previous terms: $5 + 8 = 13$ . Which number in the sequence when converted to binary would include the 4th occurrence of the substring "10" when considering each number separately?	A. 8 B. 13 C. 21 D. 34 E. 55
<b>3. Recursive Functions</b>  Find $f(10)$ , given $f(x) = \begin{cases} f(x-2) + 3 & \text{if } x \geq 7 \\ f(x-1) - 1 & \text{if } 3 < x < 7 \\ x^2 & \text{if } x \leq 3 \end{cases}$	A. 6 B. 7 C. 8 D. 9 E. 12
<b>4. Recursive Functions</b>  Find $f(20, 12)$ , given $f(x, y) = \begin{cases} f(x-3, y+1) + 3 & \text{if } x > y \\ 2 * f(x+2, y-3) - 1 & \text{if } x = y \\ x + y & \text{if } x < y \end{cases}$	A. 29 B. 34 C. 63 D. 23 E. 60

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**5. What Does This Program Do? (Branching)**

What is the output when this program is executed?

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a = 0 : b = 2 : c = 4 : d = 6
if c > d / b then
    c = b * d
end if
if b ^ 2 < c / d then
    c = b ^ 2
else
    b = b ^ 2
end if
if c - d < a * b then
    a = b + c
end if
if a ^ 2 > 1 then
    b = b + a
else
    b = b + d
end if
output c / d - b + a ^ 3 * d
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- A. -8
- B. 0
- C. -2
- D. -4
- E. 2

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