



American Computer Science League

2019-2020

Contest #1

SENIOR DIVISION

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

1. Computer Number Systems

Evaluate and express the answer in hex:

$$(42_8) * (42_8)$$

1.

2. Computer Number Systems

Tickets to a play were numbered sequentially starting at 100_{10} . A ticket that contains the sequence "1010" when the number is converted to binary is free. If 100 tickets were sold at \$5.00 each, what was the income from the tickets?

2.

3. Recursive Functions

Find $f(31)$ given: ($[x]$ = greatest integer $\leq x$)

$$f(x) = \begin{cases} f([x/2] - 5) + 4 & \text{if } x \geq 8 \\ f(x+2) - 2^x & \text{if } x \leq 4 \\ x - 4 & \text{otherwise} \end{cases}$$

3.



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4. Recursive Functions

Find $f(2, 16, 8)$ if given:

$$f(x, y, z) = \begin{cases} f(x + 1, y - 4, z) + x * z & \text{if } y \geq 7 \\ f(x - 2, y + 1, z - 2) - x * y & \text{if } 4 \leq y < 7 \\ x + y + z & \text{if } y < 4 \end{cases}$$

4.

Question #5 is on the next page.



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5.

5. What Does This Program Do?

What is outputted when this program is executed?

```
a = 20: b = 4
c = a / b
if a / b < a / c then
    d = b + c
end if
d = c - b
if b ^ d > c ^ d then
    e = b + d
else
    e = c + d
end if
f = a - b * c + d ^ e
if (c * e - a < 0) || (d - f < 0) then
    d = 2 * d
else
    f = 3 * f
end if
if (a / e > f) && (a / f < c) then
    b = e - c
end if
a = e * f - b
if (a - b < 2 * c) || ((b = c - d) && (e > f)) then
    f = b + d - c
end if
g = (a + b) / e + c
h = a / (d + e) * b * g / b ^ 2 - c ^ f + 4 * ((c + d) / (e - b)) ^ (g / b)
print h
end
```