ACSL

American Computer Science League

2019-2020 — **Contest #2**

SENIOR DIVISION SOLUTIONS

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1. Prefix/Infix/Postfix Notation

1. As shown

Prefix: * a + a ↑ + ↑ a 2 * 4 ↑ b 2 / 1 2
= * a + a ↑ + (↑ a 2) * 4 (↑ b 2) (/ 1 2)
= * a + a ↑ + (a ↑ 2) (4 * (b ↑ 2) (1/ 2)
= * a + a ↑ ((a ↑ 2) + (4 * (b ↑ 2)) (1/ 2)
= * a + a (((a ↑ 2) + (4 * (b ↑ 2)) ↑ (1/ 2))
= * a (a + (((a ↑ 2) + (4 * (b ↑ 2)) ↑ (1/ 2)))
= (a * (a + (((a ↑ 2) + (4 * (b ↑ 2)) ↑ (1/ 2))))
Infix: a * (a + (a ↑ 2 + 4 * b ↑ 2) ↑ (1/ 2))
= a * (a + ((a ↑ 2) + 4 * (b ↑ 2)) ↑ (1 2 /))
= a * (a + ((a 2 ↑) + (4 * (b 2 ↑)) (↑ (1 2 /)))
= a * (a + (a 2 ↑ 4 b 2 ↑ * + 1 2 /↑))
= a * (a a 2 ↑ 4 b 2 ↑ * + 1 2 /↑ +)
= a a a 2 ↑ 4 b 2 ↑ * + 1 2 / ↑ + *
Postfix: a a a 2 ↑ 4 b 2 ↑ * + 1 2 / ↑ + *

This is the formula for the surface area of a square pyramid with a base of length a and height of b.

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2. Prefix/Infix/Postfix Notation

2. 55

- # / + 7 5 2 - 6 * 4 1 ↑ 4 2 @ - 6 3 + 5 2 ↑ 2 3
= - # / (+ 7 5) 2 - 6 (* 4 1) (↑ 4 2) @ (- 6 3) (+ 5 2) (↑ 2 3)
= - # (/ 12 2) (- 6 4) 16 (@ 3 7 8)
= - (# 6 2 16) 9
= (- 64 9) = 55

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3. Bit-String Flicking

3. 11101

(LCIRC-2 01101) OR (NOT 10110) AND (RSHIFT-1 (RCIRC-2 10110))
= 10101 OR 01001 AND (RSHIFT-1 10101)
= 10101 OR 01001 AND 01010
= 10101 OR 01000 = 11101

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4. Bit-String Flicking

Let X = abcde
LHS = (LSHIFT -1 10111) OR (LCIRC -2 (RSHIFT - 1 abcde))
AND RCIRC -3 (NOT 01101))
= 01110 OR (LCIRC -2 0abcd) AND (RCIRC -3 10010)
= 01110 OR bcd0a AND 01010
= 01110 OR 0c000
= 01110
LHS = RHS = 01110
Therefore a = *, b = *, c =*, d = *, e = *

4. *****

5. LISP

(CAR (CDR(CAR (REVERSE (CDR '((a (b c)) c d (e (d a (c b (e)))))))))
= (CAR (CDR (CAR (REVERSE ' (c d (e (d a (c b (e)))))))))
= (CAR (CDR (CAR ' ((e (d a (c b (e))))d c))))
= (CAR (CDR ' (e (d a (c b (e))))))
= (CAR ' ((d a (c b (e)))))
= (d a (c b (e)))

5. (d a (c b (e)))