

American Computer Science League

2023 -2024 • Contest 2: Short Problems Solutions • Intermediate Division

1. Prefix/Infix/Postfix Notation

$$\begin{aligned}5\ 8 -\ 6\ 9\ 6 -\ * \ 3\ /\ + &= (5\ 8 -)\ 6\ (9\ 6 -)\ * \ 3\ /\ + \\&= (-3)\ (6\ 3\ *)\ 3\ /\ + \\&= (-3)\ (18\ 3\ /\)\ + \\&= (-3)\ 6\ + \\&= 3\end{aligned}$$

C. 3

2. Prefix/Infix/Postfix Notation

$$\begin{aligned}&\frac{(a+b)^2-c}{d+e(b^2-a)} \\&= ((a+b)^2-c) / (d+e*(b^2-a)) \\&= ((+ab)^2-c) / (d+e*(^b2-a)) \\&= ((^+ab2)-c) / (d+e*(-^b2a)) \\&= (-^+ab2c) / (d+(*e-^b2a)) \\&= (-^+ab2c) / (+d*e-^b2a) \\&= /-^+ab2c+d*e-^b2a\end{aligned}$$

E. $/-^+ab2c+d*e-^b2a$

3. Bit-String Flicking

$$\begin{aligned}&(\text{LCIRC-2 (RSHIFT-1 (NOT 10100))) OR (RCIRC-1 (LSHIFT-2 10111))} \\&= (\text{LCIRC-2 (RSHIFT-1 01011)}) \text{ OR } (\text{RCIRC-1 11100}) \\&= (\text{LCIRC-2 00101}) \text{ OR } 01110 \\&= 10100 \text{ OR } 01110 \\&= 11110\end{aligned}$$

D. 11110

4. Bit-String Flicking

Let $X = abcde$

$LHS = (LCIRC-2\ 01101) \text{ AND } X \text{ OR } (RSHIFT-1\ 01111)$

$= (LCIRC-2\ 01101) \text{ AND } abcde \text{ OR } (RSHIFT-1\ 01111)$

$= (10101 \text{ AND } abcde) \text{ OR } 00111$

$= a0c0e \text{ OR } 00111$

$= a0111$

$RHS = 10111$

$LHS = RHS \Rightarrow a0111 = 00111 \Rightarrow a = 1, b = *, c = *, d = *, e = *$

Therefore $x = 1****$

B. 1****

5. LISP

$(CAR (CDR (CAR (CDR '(5 (2 (3 4) 1) (6 7 8) 9)))))$

$= (CAR (CDR (CAR '((2 (3 4) 1) (6 7 8) 9))))$

$= (CAR (CDR '(2 (3 4) 1)))$

$= (CAR '((3 4) 1))$

$= (3 4)$

C. (3 4)