

American Computer Science League

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

1. Prefix/Infix/Postfix Notation $\begin{aligned} - + 2 * 3 8 / * 6 2 3 &= - + 2 (* 3 8) / (* 6 2) 3 \\ &= - (+ 2 24) (/ 12 3) \\ &= - 26 4 \\ &= 22 \end{aligned}$	C. 22
2. Prefix/Infix/Postfix Notation $\frac{A + B}{C - 1} + \frac{2 * A - 3}{D}$ $\begin{aligned} &= ((A + B) / (C - 1)) + ((2 * A - 3) / D) \\ &= ((A B +) / (C 1 -)) + ((2 A * 3 -) / D) \\ &= (A B + C 1 - /) + (2 A * 3 - D /) \\ &= A B + C 1 - / 2 A * 3 - D / + \end{aligned}$	B. AB+C1-/2A*3-D/+
3. Bit-String Flicking $\begin{aligned} &00110 \text{ OR } 01100 \text{ XOR } 11010 \\ &= 00110 \text{ OR } (01100 \text{ XOR } 11010) \\ &= 00110 \text{ OR } 10110 \\ &= 10110 \end{aligned}$	E. 10110
4. Bit-String Flicking $\begin{aligned} &(\text{LSHIFT-1 } 01110) \text{ AND } (\text{RCIRC-2 } (10110 \text{ OR NOT } 10101)) \\ &= 11100 \text{ AND } (\text{RCIRC-2 } (10110 \text{ OR } 01010)) \\ &= 11100 \text{ AND } (\text{RCIRC-2 } 11110) \\ &= 11100 \text{ AND } 10111 \\ &= 10100 \end{aligned}$	A. 10100

5. What Does This Program Do? (Looping)

It takes 10 days for you to make more money by getting a penny a day and doubling it every day after that than by getting a dollar a day. The following table traces this program.

p	d	t	t < d
.01	1	.01	.01 < 1
.02	2	.03	.03 < 2
.04	3	.07	.07 < 3
.08	4	.15	.15 < 4
.16	5	.31	.31 < 5
.32	6	.63	.63 < 6
.64	7	1.27	1.27 < 7
1.28	8	2.55	2.55 < 8
2.56	9	5.11	5.11 < 9
5.12	10	10.23	10.23 > 10

D. 10