Zonal Informatics Olympiad, 2024

Solutions

1. Sum $A_1 + A_2 + \ldots + A_N$

   (a) $N = 3$
   $S = [-5, -3, -2, 0, 0, 2, 3, 5]$
   Answer: 0

   (b) $N = 6$
   $S = [\ 0, 0, 1, 1, 2, 2, 3, 3, 3, 3, 4, 4, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6,$
   $7, 7, 7, 7, 8, 8, 8, 8, 8, 8, 9, 9, 9, 9, 9, 9, 10, 10, 10, 10,$
   $11, 11, 11, 11, 11, 11, 12, 12, 12, 12, 13, 13, 14, 14,$
   $14, 14, 15, 15, 16, 16, 17, 17]$
   Answer: 17

   (c) $N = 6$
   $S = [\ -19, -18, -16, -15, -14, -13, -12, -11, -11,$
   $-11, -10, -10, -10, -9, -9, -8, -8, -7, -7,$
   $-7, -6, -6, -6, -5, -5, -4, -4, -4, -3, -3,$
   $-3, -3, -2, -2, -2, -2, -1, -1, -1, 0, 0, 1, 1, 1,$
   $2, 2, 2, 3, 3, 4, 4, 5, 5, 5, 6, 6, 6, 7, 8, 9, 10, 11, 13, 14]$
   Answer: -5

2. Minimum number of operations to make pillar sequence beautiful

   (a) $N = 3$
   $H = [2, 4, 6]$
   Answer: 2

   (b) $N = 12$
   $H = [1, 2, 3, 1, 1, 5, 1, 3, 5, 3, 11, 11]$
   Answer: 31

   (c) $N = 20$
   $H = [\ 12, 21, 13, 9, 19, 17, 15, 18, 22, 19,$
   $17, 19, 15, 20, 24, 17, 35, 25, 25, 29]$
   Answer: 67

3. Maximum total distance

   (a) $N = 5$
   $P = [0, 0, 0, 1]$
   $W = [1, 1, 1, 1]$
   Answer: 18

   (b) $N = 10$
   $P = [0, 1, 2, 3, 4, 5, 6, 7, 8]$
   $W = [10, 12, 2, 3, 6, 5, 8, 9, 11]$
   Answer: 1382

(c) $N = 15$
$P = [0, 0, 0, 1, 1, 2, 3, 4, 0, 6, 6, 6, 11, 11]$
$W = [9, 8, 19, 5, 6, 2, 2, 4, 5, 20, 25, 11, 15, 13]$
Answer: 5054

4. Number of good subsets

(a) $N = 4$
$C = [red, red, green, green]$
Answer: 14

(b) $N = 8$
$C = [red, red, red, green, green, green, blue, blue]$
Answer: 237

(c) $N = 20$
$C = [\ red, green, green, green, blue, blue, blue,$
$yellow, yellow, yellow, yellow, yellow, yellow,$
$purple, purple, purple, purple,$
$purple, purple, purple]$
Answer: 1020638

Marking

The question paper carries 80 marks, broken up into four questions of 20 marks each. Each question has three parts. *If you solve all three parts correctly, you get 20 marks for that question.* Otherwise, you get 5 marks for each part that you solve correctly.

Qualifying cutoff

- Std 12: 55
- Std 11: 50
- Std 10: 45
- Std 9: 40
- Std 8 and below: 35

The cutoff score is relaxed by 5 marks for female students in each category.

Score distribution

Score	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0
Number at or above this score	6	6	14	20	36	51	90	110	138	160	195	220	252	275	305	322	332