

Editorial Presentation of CODEWARE'18 Intra AUST Programming Contest

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Intra AUST Programming Contest Spring 2018- At A Glance

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Intra AUST Programming Contest Spring 2018- At A Glance

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Intra AUST Programming Contest Spring 2018- At A Glance

- 51 teams participated
- ACM Style Contest
- 11 Problems altogether
- Most solved problem: Problem F (Inside the range)
- 5 Unsolved Problems
 - Problem A (Juglu the Runners-Up Footballer)
 - Problem C (What a prediction!)
 - Problem G (TikiTaka Snoozefest)
 - Problem I (Angle Calculation)
 - problem K (Final !!)
- Champion team solved 6 problems

Problem A. Juglu the Runners-Up Footballer

Problem Setter

Musfiqur Sanim

Software Engineer,
Enosis Solutions Ltd.

Problem Categories

Bitmask DP, Bipartite Matching

Problem A. Juglu the Runners-Up Footballer

Solution using Bitmask DP

- $n \leq 20$ is a good hint for bitmask DP approach
- $dp[mask, i] = 1$ if we can find a way to assign 1 to n to each players' favourite number from this state
 - i - i^{th} player
 - $mask$ - bit mask representing players taken from 1 to n
- $arr[i]$ - i^{th} player's favourite numbers

Problem A. Juglu the Runners-Up Footballer

Solution using Bitmask DP

- $dp[mask, i] = \forall_{j \in K} dp[\text{mask with } j^{th} \text{ bit on}, i + 1]$
 - $K = \{x | x \in [1, n], x^{th} \text{ bit in mask is off and } arr[i] \% x == 0\}$
- Find smallest j for the lexicographically smallest combination

Problem A. Juglu the Runners-Up Footballer

Solution using Bipartite Matching

- Construct a graph where favourite number are connected to their divisor number between 1 to n .
- Apply Bipartite matching on that graph.
- number of matching $< n \implies$ “Again Runners-up”
- For lexicographically smallest one, modify the BPM to handle this.

Problem B. Prime Summation

Problem Setter

Rajon Bardhan

Lecturer

Southeast University

Problem Categories

Number Theory, Implementation, Trial and Error

Problem B. Prime Summation

- Try to find out the solutions for 1 – 30 by hand.
- **Observation-** Only 1, 4, 6 can not be written as a sum of unique primes
- NO for 1, 4, 6; YES for others.
- Lesson: *trial and error method often comes handy!!*

Problem C. What a prediction!

Problem Setter

Arnab Das

Software Engineer

Cefalo Bangladesh Ltd.

Problem Categories

String Matching

Problem C. What a prediction!

- **Observation-** Constraints hint about straightforward techniques
- KMP, Rolling Hash for matching and pre-calculation
- Pre-calculation again after deletion
 - Starting from pattern string again \implies **TLE!!**
 - Starting from deleted character index \implies **Accepted!!**

Problem D. Yet Another Longest Path Problem

Problem Setter

Ridowan Muhammad

Software Engineer

TigerIT Bangladesh Ltd.

He also trains the prospective and experienced contestants of AUST nowadays.

Problem Categories

Graph theory (Depth First Search)

Problem D. Yet Another Longest Path Problem

- Judge solution built a composite node made out of two nodes(source, destination) and the cost to reach the destination
- Run DFS from source node
- Check if the cost so far exceeds W
- For destination node, check for different costs W , $W - 1$, $W - 2$ and see if the corresponding composite node was visited; if so, this is the solution-otherwise no path will be found

Problem E. Strange Game

Problem Setter

Shakil Ahmed

Software Engineer,
CodeMarshal

Problem Categories

Mathematics

Problem E. Strange Game

- $S = \sum_{i=1}^n (a_i - x)^2$
- $\frac{ds}{dx} = - \sum_{i=1}^n 2(a_i - x)$
- Set $\frac{ds}{dx} = 0$ to get $x = \frac{\sum_{i=1}^n a_i}{n}$

Problem F. Inside the range

Problem Setter

Sifat Shishir

Software Engineer,
Enosis Solutions Ltd.

Problem Categories

Ad-hoc

Problem F. Inside the range

- Easiest problem in the set
- Just be careful about whether $X > Y$ or $X < Y$

Problem G. TikiTaka Snoozefest

Problem Setter

Mir Imtiaz Mostafiz

Lecturer,
Ahsanullah University of Science and Technology

Problem Categories

Counting/Combinatorics

Problem G. TikiTaka Snoozefest

Symbols	Significance
$D(i)$	# of passes in i^{th} passing move between Defenders
$M(i)$	# of passes in i^{th} passing move between Midfielders
$A(i)$	# of passes in i^{th} passing move between Attackers
a	# of passing moves between Defenders
b	# of passing moves between Midfielder
c	# of passing moves between Attackers

Problem G. TikiTaka Snoozefest

- $d(i) = D(i) - M, m(i) = M(i) - N, A(i) = A(i) - Q$
- $a * (D(i) - M) \text{ passes} + b * (M(i) - N) \text{ passes} + c * (A(i) - Q) \text{ passes} + (L - 1) \text{ passes} = P \text{ passes}$
- $$\implies d(1) + \dots + d(a) + m(1) + \dots + m(b) + a(1) + \dots + a(c) = P - (L - 1) - aM - bN - cQ$$
- Number of ways $P - (L - 1) - aM - bN - cQ$ can be expressed as sum of $a + b + c = L$ non-negative integers
- $\binom{P - (L - 1) - aM - bN - cQ + L - 1}{L - 1} = \binom{P - aM - bN - cQ + L - 1}{L - 1}$
- Source code Length < Statement Length

Problem H. Not Argentina's match

Problem Setter

Mahir Asef Kabir

Software Engineer,
Enosis Solutions Ltd.

Problem Categories

Dynamic Programming

Problem H. Not Argentina's match

- Straightforward 0-1 Knapsack problem
- Just be careful about constraints

Problem I. Angle Calculation

Problem Setter

Shahariar Shibli

Student,
Ahsanullah University of Science and Technology

Problem Categories

Geometry

Problem I. Angle Calculation

- Do some angle chasing to find $\angle BEC$ and $\angle AEC$
- From $\triangle BEC$, using Sine law find CE .
- From $\triangle AEC$, using Cosine law find AC .
- From $\triangle AEC$, using Sine law find $\angle EAC$.

Problem J. Goal History

Problem Setter

Shagor Hasan

Software Engineer,
Enosis Solutions Ltd.

Problem Categories

Sorting, Searching

Problem J. Goal History

- Sort the goal history in order of years
- For each query, answer it by searching the sorted list
- Binary search can be used too for solving this problem

Problem K. Final !!

Problem Setter

Muhammad Ahasanuzzaman

Lecturer,

Ahsanullah University of Science and Technology (On Study Leave, Currently pursuing M.Sc. in Computing in Queen's University, Ontario, Canada)

Problem Categories

Mathematics, Probability, Implementation

Problem K. Final !!

- Second easiest problem of the set
- No input, so find the answer for team 7 only
- Implementation is almost same as the one given for team 1 as sample.

Thank you for your precious time. Any question?