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| http://ace.delos.com/usaco/cowhead2.gif | |  | | --- | | Contest: NOV10 **GOLD** Division | |  | |  | |  | |

**ANALYSIS MODE  
Submit solutions for your own enjoyment.**

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**GOLD PROBLEMS**

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**Three problems numbered 1 through 3**

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**Problem 1: Cow Photographs [Travis, 2010]**

**Farmer John wants to take a picture of his entire herd of N (1 <=**

**N <= 100,000) cows conveniently numbered 1..N so he can show off**

**to his friends.**

**On picture day, the cows run to form a single line in some arbitrary**

**order with position i containing cow c\_i (1 <= c\_i <= N). Farmer**

**John has his own ideas about how the cows should line up.**

**FJ thinks cow i may stand only to the left of cow i+1 (for all i,**

**1 <= i <= N-1) and that cow N may only stand to the left of Cow 1.**

**Of course, no cow will stand to the left of the first (leftmost)**

**cow in the line.**

**The cows are hungry for the promised post-photo dinner, so Farmer**

**John wants to take the picture as quickly as possible. Cows are not**

**great at following directions, so he will only choose a pair of**

**adjacent cows and have them switch places once per minute. How**

**quickly is Farmer John able to get them into some acceptable order?**

**Consider a set of 5 cows whose initial lineup looks like this:**

**Left Right**

**3 5 4 2 1**

**He can first swap the second pair of cows:**

**3 4 5 2 1**

**and then swap the rightmost pair:**

**3 4 5 1 2**

**to yield an acceptable lineup that required but two minutes of cow**

**swapping.**

**PROBLEM NAME: cowpic**

**INPUT FORMAT:**

**\* Line 1: A single integer: N**

**\* Lines 2..N+1: Line i+1 contains the number of the i-th cow in line:**

**c\_i**

**SAMPLE INPUT (file cowpic.in):**

**5**

**3**

**5**

**4**

**2**

**1**

**OUTPUT FORMAT:**

**\* Line 1: The minimum amount of time, in minutes, that it takes Farmer**

**John to get the cows into some appropriate order.**

**SAMPLE OUTPUT (file cowpic.out):**

**2**

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**Problem 2: Buying Feed [Tom Conerly, 2009]**

**Farmer John needs to travel to town to pick up K (1 <= K <= 10,000)**

**pounds of feed. Driving a mile with K pounds of feed costs FJ K\*K**

**cents; driving D miles with K pounds of feed in his truck costs FJ**

**D\*K\*K cents.**

**FJ can purchase feed from any of N (1 <= N <= 500) stores (conveniently**

**numbered 1..N) that sell feed. Each store is located on a segment**

**of the X axis whose length is E (1 <= E <= 500) miles. Store i is**

**at location X\_i (0 < X\_i < E) on the number line and can sell FJ**

**as much as F\_i (1 <= F\_i <= 10,000) pounds of feed at a cost of C\_i**

**(1 <= C\_i <= 10,000,000) cents per pound. Surprisingly, a given**

**point on the X axis might have more than one store.**

**FJ starts driving at location 0 on this number line and can drive**

**only in the positive direction, ultimately arriving at location E**

**with at least K pounds of feed. He can stop at any of the feed**

**stores along the way and buy any amount of feed up to the the store's**

**limit.**

**What is the minimum amount FJ must pay to buy and transport the K**

**pounds of feed? FJ knows he can purchase enough feed.**

**Consider this example where FJ needs two pounds of feed which he**

**must purchase from some of the three stores at locations 1, 3, and**

**4 on a number line whose range is 0..5:**

**0 1 2 3 4 5 X**

**+---|---+---|---|---+**

**1 1 1 Available pounds of feed**

**1 2 2 Cents per pound**

**It is most economical for FJ to buy one pound of feed from both the**

**second and third stores. He must pay two cents to buy each pound**

**of feed for a total cost of 4. FJ's driving from location 0 to**

**location 3 costs nothing, since he is carrying no feed. When FJ**

**travels from 3 to 4 he moves 1 mile with 1 pound of feed, so he**

**must pay 1\*1\*1 = 1 cents.**

**When FJ travels from 4 to 5 he moves one mile with 2 pounds of feed,**

**so he must pay 1\*2\*2 = 4 cents.**

**His feed cost is 2 + 2 cents; his travel cost is 1 + 4 cents. The**

**total cost is 2 + 2 + 1 + 4 = 9 cents.**

**TIME LIMIT: 2.5 seconds**

**PROBLEM NAME: feed**

**INPUT FORMAT:**

**\* Line 1: Three space-separated integers: K, E, and N**

**\* Lines 2..N+1: Line i+1 contains three space-separated integers: X\_i,**

**F\_i, and C\_i**

**SAMPLE INPUT (file feed.in):**

**2 5 3**

**3 1 2**

**4 1 2**

**1 1 1**

**OUTPUT FORMAT:**

**\* Line 1: A single integer that is the minimum cost for FJ to buy and**

**transport the feed**

**SAMPLE OUTPUT (file feed.out):**

**9**

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**Problem 3: Visiting Cows [Neal Wu, 2008]**

**After many weeks of hard work, Bessie is finally getting a vacation!**

**Being the most social cow in the herd, she wishes to visit her N**

**(1 <= N <= 50,000) cow friends conveniently numbered 1..N. The cows**

**have set up quite an unusual road network with exactly N-1 roads**

**connecting pairs of cows C1 and C2 (1 <= C1 <= N; 1 <= C2 <= N; C1**

**!= C2) in such a way that there exists a unique path of roads between**

**any two cows.**

**FJ wants Bessie to come back to the farm soon; thus, he has instructed**

**Bessie that if two cows are directly connected by a road, she may**

**not visit them both. Of course, Bessie would like her vacation to**

**be as long as possible, so she would like to determine the maximum**

**number of cows she can visit.**

**PROBLEM NAME: vacation**

**INPUT FORMAT:**

**\* Line 1: A single integer: N**

**\* Lines 2..N: Each line describes a single road with two**

**space-separated integers: C1 and C2**

**SAMPLE INPUT (file vacation.in):**

**7**

**6 2**

**3 4**

**2 3**

**1 2**

**7 6**

**5 6**

**INPUT DETAILS:**

**Bessie knows 7 cows. Cows 6 and 2 are directly connected by a road,**

**as are cows 3 and 4, cows 2 and 3, etc. The illustration below depicts the**

**roads that connect the cows:**

**1--2--3--4**

**|**

**5--6--7**

**OUTPUT FORMAT:**

**\* Line 1: A single integer representing the maximum number of cows**

**that Bessie can visit.**

**SAMPLE OUTPUT (file vacation.out):**

**4**

**OUTPUT DETAILS:**

**Bessie can visit four cows. The best combinations include two cows**

**on the top row and two on the bottom. She can't visit cow 6 since**

**that would preclude visiting cows 5 and 7; thus she visits 5 and**

**7. She can also visit two cows on the top row: {1,3}, {1,4}, or**

**{2,4}.**

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