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| http://ace.delos.com/usaco/cowhead2.gif | |  | | --- | | Contest: DEC10 **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 Calisthenics [Michael Cohen, 2010]**

**Farmer John continues his never-ending quest to keep the cows fit**

**by having them exercise on various cow paths that run through the**

**pastures. These cow paths can be represented as a set of vertices**

**connected with bidirectional edges so that each pair of vertices**

**has exactly one simple path between them. In the abstract, their**

**layout bears a remarkable resemblance to a tree. Surprisingly, each**

**edge (as it winds its way through the pastures) has the same length.**

**For any given set of cow paths, the canny cows calculate the longest**

**possible distance between any pair of vertices on the set of cowpaths**

**and call it the pathlength. If they think this pathlength is too**

**large, they simply refuse to exercise at all.**

**Farmer John has mapped the paths and found V (2 <= V <= 100,000)**

**vertices, conveniently numbered from 1..V. In order to make shorter**

**cowpaths, he can block the path between any two vertices, thus**

**creating more sets of cow paths while reducing the pathlength of**

**both cowpath sets.**

**Starting from a single completely connected set of paths (which**

**have the properties of a tree), FJ can block S (1 <= S <= V-1)**

**paths, creating S+1 sets of paths. Your goal is to compute the best**

**paths he can create so that the largest pathlength of all those**

**sets is minimized.**

**Farmer John has a list of all V-1 edges in his tree, each described**

**by the two vertices A\_i (1 <= A\_i <= V) and B\_i (1 <= B\_i <= V; A\_i**

**!= B\_i) that it connects.**

**Consider this rather linear cowpath set (a tree with 7 vertices):**

**1---2---3---4---5---6---7**

**If FJ can block two paths, he might choose them to make a map like**

**this:**

**1---2 | 3---4 | 5---6---7**

**where the longest pathlength is 2, which would be the answer in**

**this case. He can do no better than this.**

**TIME LIMIT: 2 seconds**

**MEMORY LIMIT: 32 MB**

**PROBLEM NAME: exercise**

**INPUT FORMAT:**

**\* Line 1: Two space separated integers: V and S**

**\* Lines 2..V: Two space separated integers: A\_i and B\_i**

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

**7 2**

**6 7**

**3 4**

**6 5**

**1 2**

**3 2**

**4 5**

**OUTPUT FORMAT:**

**\* Line 1: A single integer that is the best maximum pathlength FJ can**

**achieve with S blocks**

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

**2**

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**Problem 2: Big Macs Around the World [Sherry Wu, a classic, 2010]**

**Bessie is studying her favorite subject, Macroeconomics, in cowllege.**

**For her final project, she will be presenting research on exchange**

**rates between countries around the world.**

**In order to make her presentation more lively, she would like to**

**show the relative prices of Big Macs around the world, despite their**

**rather unsavory contents. To illustrate, suppose that Bessie would**

**like to find smallest value of a Big Mac in a country given its**

**value in some initial country and exchange rates from which other**

**country's values can be calculated (as illustrated below):**

**\* A Big Mac is worth 60 dollars in the United States**

**\* The exchange rate from US dollars to Canadian dollars is 0.2**

**Canadian dollars per US dollar**

**\* The exchange rate from US dollars to British Pounds is 5.00 British**

**Pounds per US Dollar**

**\* The exchange rate from British Pounds to Canadian dollars is 0.5**

**Canadian dollars per British Pound**

**\* The exchange rate between Canadian dollars to US dollars is 5.00**

**US dollars per Canadian dollar**

**and Bessie would like to find the smallest possible value of a Big**

**Mac in Canada that can be obtained by exchanging currencies. There**

**are two ways:**

**\* Going from US dollars directly to Canada dollars would yield a**

**burger worth 60.00 US dollars \* 0.2 Canadian dollars / US dollar**

**= 12.00 Canadian dollars**

**\* Going from US dollars to British Pounds to Canadian dollars would**

**yield a burger worth 60.00 US$ \* 5.00 GBP / 1 US$ \* 0.5 C$ / 1**

**GBP = 150.00 C$ (Canadian dollars).**

**Bessie would choose the former option, since she would much rather**

**pay 12.00 Canadian dollars instead of 150.00 Canadian dollars for**

**a Big Mac in Canada.**

**Bessie has N (1 <= N <= 2,000) countries conveniently labeled 1 to**

**N that she would like to consider along with a list of M (1 <= M**

**<= 25,000) exchange rates e\_ij (0.1 < e\_ij <= 10), each between**

**countries i and j (1 <= i <= N; 1 <= j <= N).**

**Given the value V (1 <= V <= 1,000,000,000,000), which is not**

**necessarily an integer, of the Big Mac in her starting country A**

**(1 <= A <= N), help her find the smallest possible value of a Big**

**Mac in country B (1 <= B <= N; B != A) after a series of currency**

**conversions. If there is no minimum, output 0.**

**It is guaranteed that the answer is, if not 0, between 1 and 10^15.**

**It is also guaranteed that, for any country's currency, it is**

**possible to get to any other country's currency.**

**TIME LIMIT: 2.0 seconds**

**PROBLEM NAME: bigmac**

**INPUT FORMAT:**

**\* Line 1: Five space-separated numbers: N, M, V, A, B**

**\* Lines 2..M+1: Three space-separated numbers: i, j, e\_ij**

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

**3 4 60 1 2**

**1 2 0.2**

**1 3 5**

**3 2 0.5**

**2 1 5**

**OUTPUT FORMAT:**

**\* Line 1: A single positive number, the price of the Big Mac, with**

**absolute or relative error at most 10^-6. If there is no**

**minimum, output 0.**

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

**12.00**

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**Problem 3: Threatening Letter [J. Kuipers, 2002]**

**FJ has had a terrible fight with his neighbor and wants to send him**

**a nasty letter, but wants to remain anonymous. As so many before**

**him have done, he plans to cut out printed letters and paste them**

**onto a sheet of paper. He has an infinite number of the most recent**

**issue of the Moo York Times that has N (1 <= N <= 50,000) uppercase**

**letters laid out in a long string (though read in as a series of**

**shorter strings). Likewise, he has a message he'd like to compose**

**that is a single long string of letters but that is read in as a**

**set of shorter strings.**

**Being lazy, he wants to make the smallest possible number of cuts.**

**FJ has a really great set of scissors that enables him to remove**

**any single-line snippet from the Moo York Times with one cut. He**

**notices that he can cut entire words or phrases with a single cut,**

**thus reducing his total number of cuts.**

**What is the minimum amount of cuts he has to make to construct his**

**letter of M (1 <= M <= 50,000) letters?**

**It is guaranteed that it is possible for FJ to complete his task.**

**Consider a 38 letter Moo York Times:**

**THEQUICKBROWNFOXDO**

**GJUMPSOVERTHELAZYDOG**

**from which FJ wants to construct a 9 letter message:**

**FOXDOG**

**DOG**

**These input lines represent a pair of strings:**

**THEQUICKBROWNFOXDOGJUMPSOVERTHELAZYDOG**

**FOXDOGDOG**

**Since "FOXDOG" exists in the newspaper, FJ can cut this piece out**

**and then get the last "DOG" by cutting out either instance of the**

**word "DOG".**

**Thus, he requires but two cuts.**

**PROBLEM NAME: letter**

**INPUT FORMAT:**

**\* Line 1: Two space-separated integers: N and M**

**\* Lines 2..?: N letters laid out on several input lines; this is the**

**text of the one copy of the Moo York Times. Each line will**

**have no more than 80 characters.**

**\* Lines ?..?: M letters that are the text of FJ's letter. Each line**

**will have no more than 80 characters.**

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

**38 9**

**THEQUICKBROWNFOXDO**

**GJUMPSOVERTHELAZYDOG**

**FOXDOG**

**DOG**

**OUTPUT FORMAT:**

**\* Line 1: The minimum number of cuts FJ has to make to create his**

**message**

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

**2**

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