Ranick Patra

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Wind Farm Optimization

+ Problem Description

Government of India has an ambitious plan to have electricity surplus by using renewable energy sources. Mr. Tripathi is in-charge of meeting electricity generation using windmills. He has ordered quotations from two companies. In interest of future proofing investment he has decided that he will at least install one windmill from both vendors so that he is able to collect feedback about both windmills. He has a fixed budget B and fixed land parcel L. Help him to maximize electricity generation without exceeding budget and within constraints of land available.

Note: Area occupied by one windmill is 2*radius*radius, air density = 1.23 kg/m and generated power is in MegaWatt.

Use the following formula for Power Generation

Power Generated = (1/2) * Air Density * Area of Windmill * Velocity ^ 3 * Efficiency Coefficient

+ Constraints

None

+ Input Format

Radius of windmill provided by company A in meters

Cost per windmill provided by company A

Efficiency of windmill provided by company A

Radius of windmill provided by company B in meters

Cost per windmillprovided by company B

Efficiency of windmill provided by company B

Total budget B

Total land available L

Wind speed in meters/ second

+ Output

Theoretical Power generated (In MegaWatt)

Largest number of wind mills from company A and largest number of windmills from company B delimited by <space> that could be commissioned so that we get as near the Power generated as possible.

Actual Power generated (in MegaWatt)

+

+ Explanation

Example 1

Input

25

40000

0.56

35

800000

0.52

22000000

60000

11.5

Output

49.22

46

1

49.18

Explanation

Company A"s specs are [25, 40000, 0.56] and Company B"s specs are [35, 800000, 0.52] where the specs correspond to [radius of windmill, cost of installing one unit, efficiency factor]. Mr. Tripathi has 22M in budget and a land parcel of 60K units. Wind speed is 11.5 m/sec. First electricity generation and space taken by each windmill type in computed. Next, upon performing optimization, the wind farm will be able to generate ~49.22 MegaWatts of electricity if it installs 46.04 windmills of company-A type and 1 windmill of company-B type. However since number of windmills should be integral the output should be 46 and 1. Hence the actual power generated is 49.18 MW

Hint: - Find the max MW that can be generated, then round down the number of windmills so that the output is integral number of windmills. Then find actual power generated.

Example 2

Input

39.5

30000

0.52

37.5

32000

0.59

225000

65500

11.5

Output

17.78

6

1

16.74

Explanation

Company A"s specs are [39.5, 30000, 0.52] and Company B"s specs are [37.5, 32000, 0.59] where the specs correspond to [radius of windmill, cost of installing one unit, efficiency factor]. Mr. Tripathi has 225K in budget and a land parcel of 65.5K units. Wind speed is 11.5 m/sec. First electricity generation and space taken by each windmill type in computed. Next, upon performing optimization, the wind farm will be able to generate ~17.78MegaWatts of electricity if it installs 6.43 windmills of company-A type and 1 windmill of company-B type. However since number of windmills should be integral the out should be 6 and 1. Hence the actual power generated is 16.74 MW

Hint: - Find the max MW that can be generated, then round down the number of windmills so that the output is integral number of windmills. Then find actual power generated.

Upload Solution [Question : A]

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