Introduction to Optimization Through the Lens of Data Science Course Exercises

Exercises - Section 4: Lecture 13 – Using Sets and Indicator Data - Questions

Suppose we have the following notation for a musical instrument manufacturer:

| DESCRIPTION | MATH | GUROBI | |
|---|-------|---|--|
| Index for instrument model | i | i | |
| Cost to manufacture each instrument of model i (data) | C_i | <pre>cost = {i: get_cost(i) for i in I}</pre> | |
| Number of instruments of model <i>i</i> made (variable) | X_i | <pre>x = m.addVars(cost, obj=cost)</pre> | |

For each of the following descriptions, create the necessary set-based notation and set-based gurobipy code for the data and/or variables.

| DESCRIPTION | MATH | GUROBI |
|-------------------------------|------|--------|
| 1. Set of instrument models | | |
| that have silver plating | | |
| 2. Set of instrument models | | |
| that are made for beginners | | |
| 3. Set of instrument models | | |
| that are sold to high schools | | |
| 4. Total silver-plated | | |
| instruments made | | |
| | | |
| 5. Total beginner | | |
| instruments made | | |
| | | |
| 6. Total cost to | | |
| manufacture silver-plated | | |
| instruments | | |
| 7. Total cost to | | |
| manufacture high-school | | |
| instruments | | |
| 8. Total silver-plated | | |
| beginner instruments made | | |
| | | |
| | | |
| | | |
| | | |
| 9. Total silver-plated high- | | |
| school instruments made | | |

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| 10. Total cost to | |
|---------------------------|--|
| manufacture silver-plated | |
| beginner instruments | |
| 11. Total cost to | |
| manufacture silver-plated | |
| high school instruments | |
| 12. Total non-silver | |
| instruments made | |
| 13. Total non-beginner | |
| instruments made | |
| 14. Total cost to | |
| manufacture non-silver | |
| instruments | |
| 15. Total non-silver | |
| beginner instruments made | |
| 16. Total cost to | |
| manufacture non-silver, | |
| non-beginner instruments | |

For each of the following descriptions, create the necessary indicator-data-based notation and indicator-data-based gurobipy code for the data and/or variables.

| DESCRIPTION | MATH | GUROBI |
|----------------------------------|------|--------|
| 1. Indicator data vector to show | | |
| which instrument models that | | |
| have silver plating | | |
| 2. Indicator data vector to show | | |
| which instrument models are | | |
| made for beginners | | |
| 3. Indicator data vector to show | | |
| which instrument models that | | |
| are sold to high schools | | |
| 4. Total silver-plated | | |
| instruments made | | |
| 5. Total beginner instruments | | |
| made | | |
| 6. Total cost to manufacture | | |
| silver-plated instruments | | |
| 7. Total cost to manufacture | | |
| high-school instruments | | |
| 8. Total silver-plated beginner | | |
| instruments made | | |
| 9. Total silver-plated high- | | |
| school instruments made | | |



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| 10. Total cost to manufacture | |
|----------------------------------|--|
| silver-plated beginner | |
| instruments | |
| 11. Total cost to manufacture | |
| silver-plated high school | |
| instruments | |
| 12. Total non-silver instruments | |
| made | |
| 13. Total non-beginner | |
| instruments made | |
| 14. Total cost to manufacture | |
| non-silver instruments | |
| 15. Total non-silver beginner | |
| instruments made | |
| 16. Total cost to manufacture | |
| non-silver, non-beginner | |
| instruments | |

| NOTES: | | |
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| NOTES. | | |
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