Network Model for Gravel Pit Corporation

# The problem description and the questions to respond

A gravel pit corporation has decided to utilize two intermediate nodes as transshipment points for the temporary storage of topsoil. The soil is to be delivered to three projects. The organization seeks to purchase the correct amount of topsoil from the right farm so that it minimizes its transportation costs and meets its project demands.

Below, we have provided a network diagram.

A diagram of a distribution network

AI-generated content may be incorrect.

* Supply node amounts per topsoil production farm are provided on the left.
* Demand node destination requirements per project are provided on the right.
* Transportation costs are shown on the connecting lines.
* Path variable notation: Xij, path from node 3 to node 5, i.e., X35

Once you have analyzed the network diagram, please respond to the following prompts (**Questions 1 to 4**):

1. **Using Xij, notation, list all the decision variables. (Hint: X14, ...).**

|  |  |  |  |
| --- | --- | --- | --- |
| From / To | Variable Name | | |
| From Farm A to Warehouses | X14 | X15 |  |
| From Farm B to Warehouses | X24 | X25 |  |
| From Farm C to Warehouses | X34 | X35 |  |
| From Warehouse 1 to Projects | X46 | X47 | X48 |
| From Warehouse 2 to Projects | X56 | X57 | X58 |

1. **Using Xij, notation, state the objective function. (Hint: 30\*X14 + 20\*X15…).**

**Minimize Z = 30 \* X14 + 20 \* X15 +**

**40 \* X24 + 30 \* X25 +**

**25 \* X34 + 35 \* X35 +**

**20 \* X46 + 10 \* X47 + 40 \* X48 +**

**30 \* X56 + 20 \* X57 + 50 \* X58**

1. **Using Xij, notation, state each node constraint (limits in resources).**

|  |  |  |
| --- | --- | --- |
| Node | Equation= | =Constraint Value |
| 1 Farm A | X14 + X15 | 1100 |
| 2 Farm B | X24 + X25 | 1200 |
| 3 Farm C | X34 + X35 | 1200 |
| 4 Warehouse 1 | X14 + X24 + X34 | X46 + X47 + X48 |
| 5 Warehouse 2 | X15 + X25 + X35 | X56 + X57 + X58 |
| 6 Project 1 | X46 + X56 | 1050 |
| 7 Project 2 | X47 + X57 | 1150 |
| 8 Project 3 | X48 + X58 | 1300 |

1. **What is the equation for the nonnegativity constraint? (Hint: Xij…).**

Xij ≥ 0 for all i and j.