**Answer 1(a):**

* Formulation

Let:

*a1* = amount of alloy 1 needed

*a2* = amount of alloy 2 needed

*a3* = amount of alloy 3 needed

*a4* = amount of alloy 4 needed

min *1a1 + 3a2 + 2a3 + 4 a4*

s. t.  *20a1 + 40a2 + 10 a3 + 35 a4* >= 60

*80a1 + 60a2 + 90 a3 + 65 a4* >= 40

*a1 , a2 , a3 , a4* ≥ 0

* Linear Optimization Code:

var a1 >= 0;

var a2 >= 0;

var a3 >= 0;

var a4 >= 0;

minimize z: 1\*a1 + 3\*a2 + 2\*a3 + 4\*a4;

subject to c1: 20\*a1 + 40\*a2 + 10\*a3 + 35\*a4 >= 60;

subject to c2: 80\*a1 + 60\*a2 + 90\*a3 + 65\*a4 >= 40;

end;

**Answer 1(b):**

Given:   
 *ai* = quantity of product shipped from ith location

b*j* = quantity of product to receive at jth location

m = number of total shipping locations

n = number of total receiving locations

c*ij* = cost to ship one product unit from ith to jth location

x*ij* = quantity of product to ship from ith to jth location

Formulation:

**Answer 1(c):**

|  |  |
| --- | --- |
| Source | Amount |
| A | 200 |
| B | 400 |

|  |  |
| --- | --- |
| Destination | Capacity |
| 1 | 250 |
| 2 | 150 |
| 3 | 100 |

|  |  |  |  |
| --- | --- | --- | --- |
| Cost from source | To 1 | To 2 | To 3 |
| A | 35 | 15 | 20 |
| B | 20 | 5 | 15 |

Given:

Let :

*Xi* be the amount shipped from A to *ith* destination

*Yi* be the amount shipped from B to *ith* destination

Formulation :

*min 35 X1 + 15 X2 + 20 X3 + 20 Y1 + 5 Y2 + 15 Y3*

*s.t. X1 + X2 + X3 = 200*

*Y1 + Y2 + Y3 = 400*

*X1 + Y1 ≤ 250*

*X2 + Y2 ≤ 150*

*X3 + Y3 ≤ 100*

*X1 , X2 , X3 , Y1 , Y2 , Y3 ≥ 0*