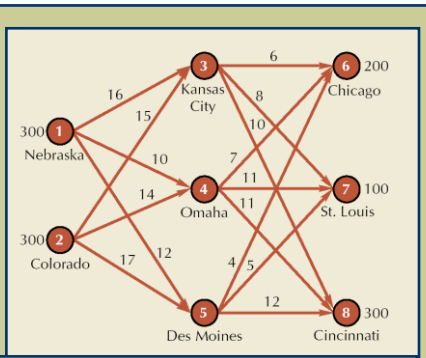
THE TRANSSHIPMENT PROBLEM

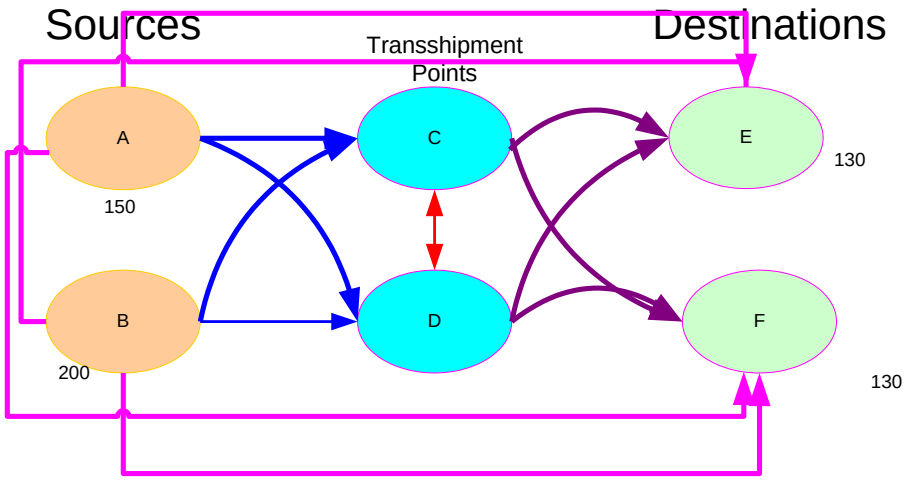
Transshipment Model



	Distribution Centers		
Farm	3. Kansas City	4. Omaha	5. Des Moines
1. Nebraska	$16	10	12
2. Colorado	15	14	17

A transportation problem allows only shipments that go directly from a supply point. In many situations, shipments are allowed between supply points and demand points. Sometimes there may also be points (**called Transshipment points**) through which goods can be transshipped on their journey from a supply point to a demand point. Shipping problems with any or all of these characteristics are transshipment problems. Fortunately, the optimal solution to a transshipment problem can be found by solving a transportation problem.

In what follows, we define a **supply point** to be a point that can send goods to another point but cannot receive goods from any other point. Similarly, a **demand point** is a point that can receive goods from other points but cannot send goods to any other point. A **transshipment point** is a point that can both receive goods from other points and send goods to other points.



A transshipment problem

Given a transshipment problem, we create a balanced transportation problem by the following procedure (assume that total supply exceeds total demand):

Step 1 ***If necessary, add a dummy demand point(equal to the problem's excess supply) to balance the problem. Shipments to the dummy and from a point to itself will, of course, have a zero shipping cost. Let S = total available supply.***

Step 2 ***Construct a transportation tableau as follows. A row in the tableau will be needed for each supply point and transshipment point, and a column will be needed for each demand point and transshipment point. Each supply point will have a supply equal to its original supply, and each demand point will have a demand equal to its original demand. Let S= total available supply. Then each transshipment point will have a supply equal to (point's original supply) + S and a demand equal to (point's original demand) + S. This ensures that any transshipment point that is a net supplier will have a net outflow equal to the point's original supply, and any transshipment point that is a net demander will have a net inflow equal to the point's original demand. Although we don't know how much will be shipped through each transshipment point, we can be sure that the total amount shipped through the point will not exceed S. This explains why we add S to the supply and demand at each transshipment point. By adding the same amounts to the supply and demand at each transshipment point, we ensure that the net outflow at each transshipment point will be correct, and we also maintain a balanced transportation tableau.***

Representation of Transshipment problem as a Balanced Transportation problem

From/To	C		D		E		F		Dummy		Supply
A		8		13		25		28		0	150
B		15		12		26		25		0	200
C		0		6		16		17		0	350
D		6		0		14		16		0	350
Demand	350		350		130		130		90		

Any starting solution of the problem

From/To	C		D		E		F		Dummy		Supply
A	**60**	8		13		25		28	**90**	0	**150**
B		15	**70**	12		26	**130**	25		0	**200**
C	**290**	0		6	**60**	16		17		0	**350**
D		6	**280**	0	**70**	14		16		0	**350**
Demand	**350**		**350**		**130**		**130**		**90**		

The value of the solution = 6510

From/To	C		D		E		F		Dummy		Supply
A	**60**	8		13		25		28	**90**	0	150 (0)
B		15	**70**	12		26	**130**	25		0 -2	200 (2)
C	**290**	0		6	**60**	16		17		0	350 (-8)
D		6	**280**	0	**70**	14		16		0	350 (-10)
Demand	350 (8)		350 (10)		130 (24)		130 (23)		90 (0)		

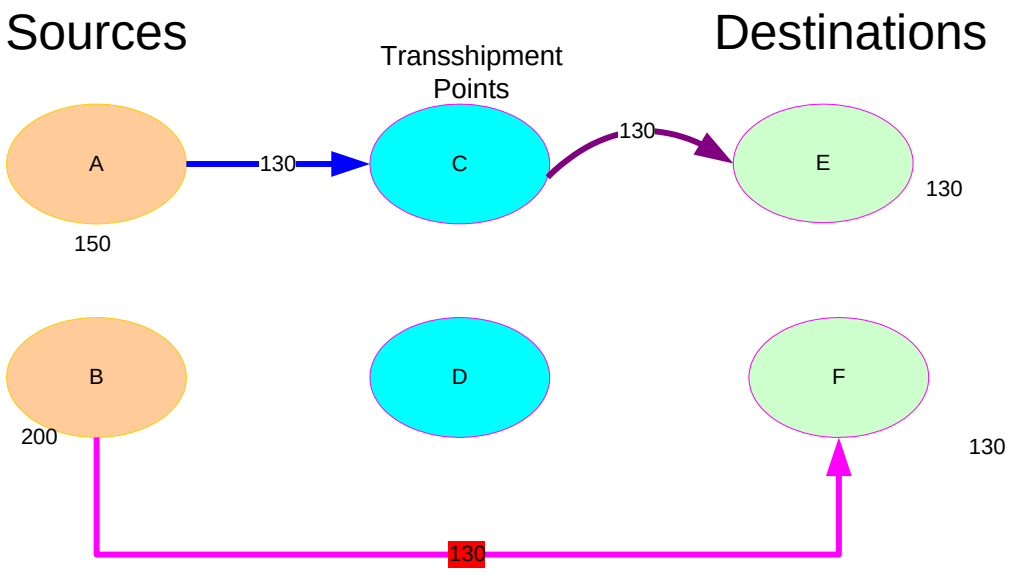
Is this optimal solution?

From/To	C		D		E		F		Dummy		Supply
A	**60**	8		13		25		28	**90**	0	150 (0)
B		15	**70**	12		26	**130**	25		0 -2	200 (2)
C	**290**	0		6	**60**	16		17		0	350 (-8)
D		6	**280**	0	**70**	14		16		0	350 (-10)
Demand	350 (8)		350 (10)		130 (24)		130 (23)		90 (0)		

α=70

From/To	C		D		E		F		Dummy		Supply
A	**130**	8		13 **1**		25 **1**		28 **3**	**20**	0	150 (0)
B		15 **7**	**0**	12 **0**		26 **2**	**130**	25	**70**	0	200 (0)
C	**220**	0		6 **2**	**130**	16		17 **0**		0 **8**	350 (-8)
D		6 **12**	**350**	0		14 **2**		16 **3**		0 **12**	350 (-12)
Demand	350 (8)		350 (12)		130 (24)		130 (25)		90 (0)		

The value of the solution = 6370 (with multiple optima)



Obtain the alternative solutions and their flow diagrams.