Geog 270a
Exercise 4: Manufacturing Location

Alfred Weber published his 'Theory of the Location of Industries' in 1909. Along with other location theorists, he assumed perfect competition. This means that individual firms cannot influence the product price which is the same everywhere.

At the prevailing price there is unlimited demand and all settlers have unlimited access to the consuming centre. Therefore the firm which secures the location where lowest costs are incurred will achieve the highest profit.

At the beginning of the 20th century transportation was a much greater element of the total cost than it is today. In fact, for many industries it was a major cost. Thu,s it is not surprising that Weber developed his theory around the cost of transportation.

However, he did recognize that other elements of total cost could also vary, particularly labour and the savings associated with agglomeration.

The first set of exercises is based on Weber's locational triangle. The triangle can be used to illustrate the effects of variations in a number of different costs.

When an entrepreneur is seeking the best location for a new factory many issues have to be considered. For example, the cost of bringing together the necessary raw materials or components at the factory and the cost of moving the final product to the market.

The following examples show how the costs of transportation can vary with location.

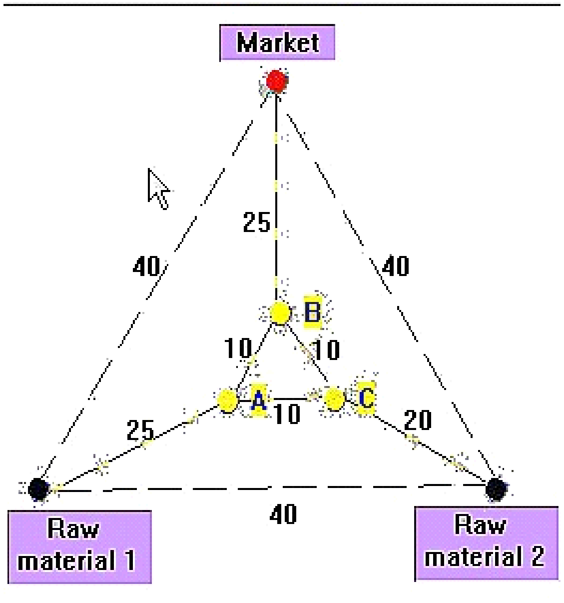
It must be remembered in reality, choosing the best location is much more difficult. Some firms use large numbers of raw materials or components and sell their products in many different markets.

The triangle shows the location of the only 2 raw materials used to manufacture a product and the single market in which the product is sold. The road network and the distance in km between road junctions is also shown.

There are 3 possible locations for the factory, A, B or C.

Two tons of raw material 1 and one ton of raw material 2 are required to manufacture one ton of the finished product.

Transport costs are $1 per ton km.



Task 1

Draw up a transport cost table	A	B	C
2 tons of RM1 to factory			
1 ton of RM2 to factory			
1 ton of product to market			
Total			

After considerable expenditure on research and development, the firm finds a way to save on the use of raw materials.

Now only one-half a ton of raw material 1 and one ton of raw material 2 are required to make one ton of the finished product.

Task 2

Complete a new transport cost matrix to find the least cost location now.

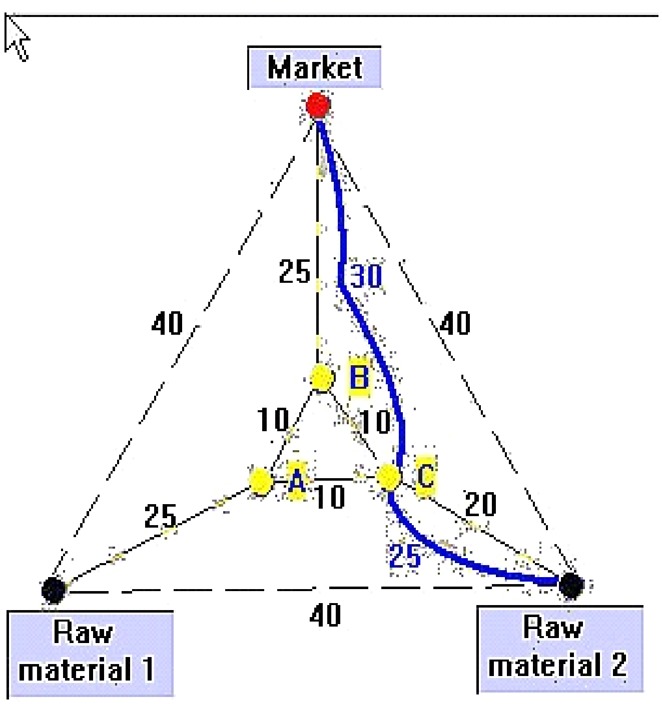
Draw up a transport cost table	A	B	C
0.5 ton of RM1 to factory			
1 ton of RM2 to factory			
1 ton of product to market			
Total			

In an effort to improve communications in the eastern part of the region, a canal has been built.

Water is usually the cheapest form of transport for bulky goods.

Here, water transport costs just 50¢ per ton per km where it can be used.

Task 3 Complete a new transport cost matrix.



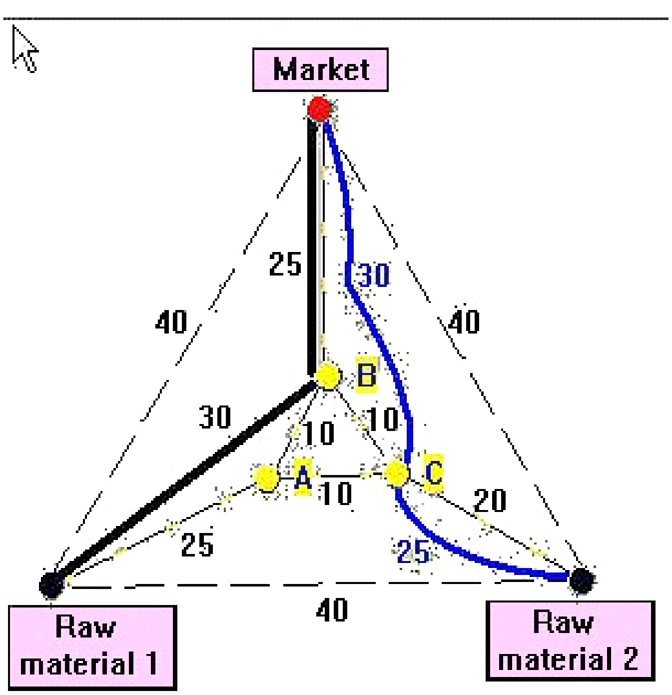
Draw up a transport cost table	A	B	C
0.5 ton of RM1 to factory			
1 ton of RM2 to factory			
1 ton of product to market			
Total			

In an effort to improve communications in the western part of the region, a railway has been built.

The railway runs from raw material 1 to B (30 km) and from B to the market (25 km)

The transport cost by rail is 70¢ per ton per km.

All other costs are the same as in the previous example.



Task 4

Draw up a transport cost table	A	B	C
0.5 ton of RM1 to factory			
1 ton of RM2 to factory			
1 ton of product to market			
Total			

In these examples the total weight of raw materials is greater than that of the finished product. This is in Weber's words a 'weight-losing industry'.

It follows that the cost of transporting raw materials to the factory is greater than the cost of moving the finished product to the market.

The least transport cost location will logically be closer to the raw materials than to the market.

However for some industries the reverse is true and the weight of the finished product is greater than the combined weight of the raw materials transported to the factory.

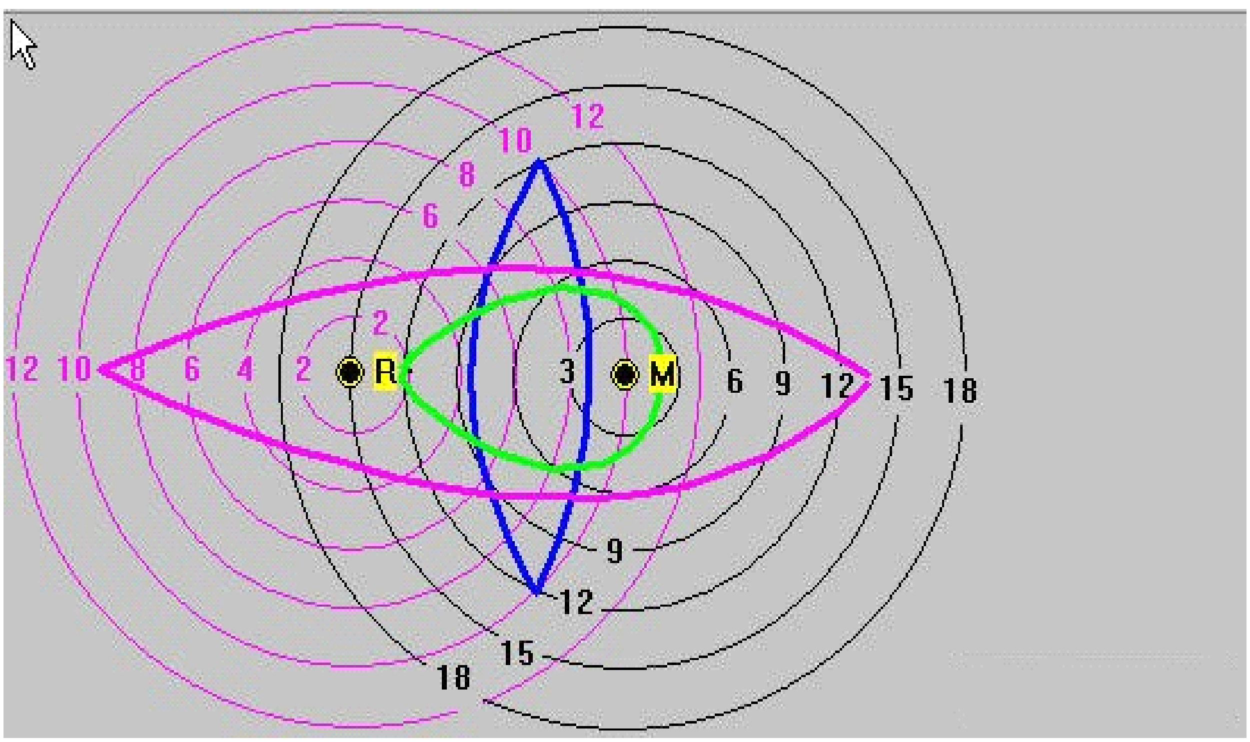
These are 'weight-gaining' industries. Brewing and soft drinks are good examples.

Weber designed a simple 'Material Index' formula to show the relationship between the two transport costs.

$$Material\ Index = \frac{weight\ of\ raw\ materials}{weight\ of\ finished\ product}$$

Task 5 Complete the table

Total weight of raw materials	Weight of finished product	Material index
3	1	
1.5	1	
7	2	
0.4	0.8	
4		2
0.5	0.1	
	1	1.25



Building on the concept of the locational triangle, the variation of transport costs in a region can be more clearly illustrated by isotims and isodapanes.

Task 6

This figure shows isotims to

1) the movement of the single raw material required to manufacture the finished product from R.

2) the movement of the product to M.

R= raw material, M = market

Mark a point of the $14 isodapane

Task 7

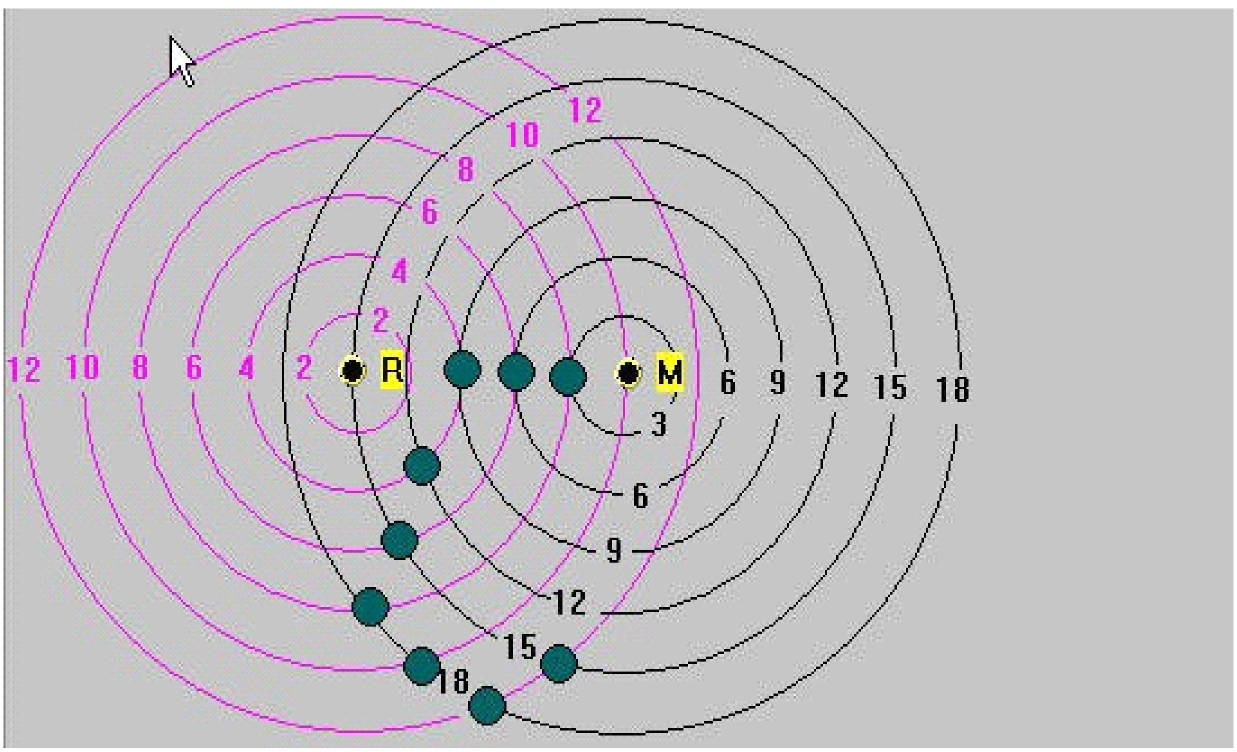
What are the total transportation costs at M and R to produce 1 ton of the finished product?

M=____, R=____.

Task 8

Mark the point that lies on the $16 isodapane.

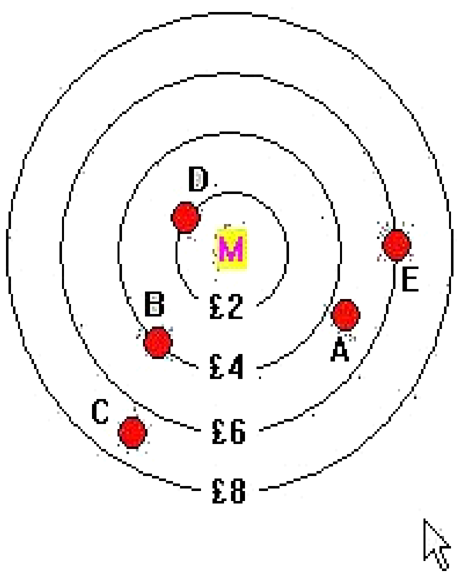
In the previous example, M is clearly the least transport cost location. Let us now assume that there is an alternative location where a saving of $4 per ton of finished product can be made in



the cost of labour. Clearly if this location is on the 14 isodapane the savings in labour cost would exactly balance the extra transport costs incurred. In this case the $14 isodapane would be the 'critical isodapane'.

If the point of cheap labour lies outside the critical isodapane, the optimum location would remain at M. If it lies within it, it would be logical for the factory to locate there since the savings in labour costs more than compensate for the extra transport costs incurred. Weber described such a shift as a deviation from the least costs transport location.

Task 9



M = least transport cost location.

A, B, C, D and E are points where labour costs are cheaper than elsewhere by £4 per tonne of finished product.

Mark those locations that are:
a) Inside the critical isodapane
b) On the critical isodapane
c) Outside the critical isodapane

Weber also recognized that the pull of low labour costs was becoming stronger as improvements in transport were increasing the distance over which goods could be moved for a given cost.

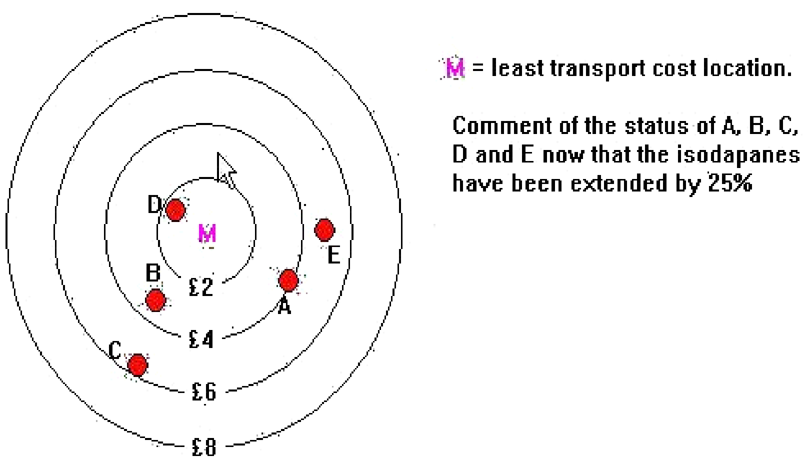
In terms of the previous figure, the distance between isodapanes was increasing. Thus more cheap labour locations would be likely to fall within the critical isodapane.

Task 10

In the figure below the isodapanes have been extended by 25%

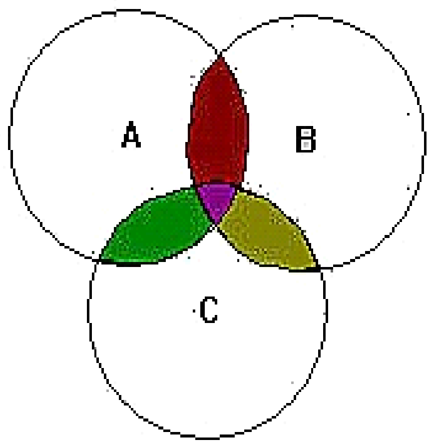
Mark those locations that are:

a) Inside the critical isodapane
b) On the critical isodapane
c) Outside the critical isodapane



Weber also recognized that savings could be made when firms located together. He referred to such savings as ‘agglomeration economies’.

The concept of the critical isodapane again comes into play.

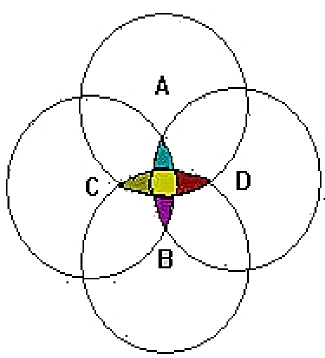


Here the least transport cost location for three factories is shown. In this example there are no variations in labour costs.

Agglomeration will only be beneficial when all three firms save more through locating together than they lose in transport costs.

Task 11

Mark where the agglomeration economies occur.



The critical isodapanes for four firms are illustrated.