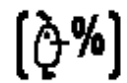


VNIVERSITAT DE VALÈNCIA



**Facultat d'Economia**

**DEGREE IN BUSINESS  
ADMINISTRATION**

**35836 Operations Management: Decisions and Resources  
(OR/English Group)**

**Solved Practical Exercises. Chapter 5. Location Analysis**

**Course: 202223**

**Professor: Emilio Camarena Gil**

## LOCATION ANALYSIS

To fully understand the theory of this concept and how to apply it, you should read the course handouts and the document:

HEIZER RENDER MUNSON 2017 LOCATION TECHNIQUES

Pages 344-347, 351, 355-356

Once the theory has been studied, the following exercises will be practised in the classroom:

### Exercise LOC 1:

A location analysis for Artemis Manufacturing, a small manufacturer of parts for high-technology cable systems, has narrowed down four locations. Artemis will need to train assemblers, testers, and robotics maintainers in local training centres. Lori Cook, the president, has asked each potential site to offer training programmes, tax breaks, and other industrial incentives. The critical factors, their weights, and the ratings for each location are shown in the following table. High scores represent favourable values.

		<i>LOCATION</i>			
<b>FACTOR</b>	<b>WEIGHT</b>	<b>AKRON, OH</b>	<b>BILOXI, MS</b>	<b>CARTHAGE, TX</b>	<b>DENVER, CO</b>
Labor availability	.15	90	80	90	80
Technical school quality	.10	95	75	65	85
Operating cost	.30	80	85	95	85
Land and construction cost	.15	60	80	90	70
Industrial incentives	.20	90	75	85	60
Labor cost	.10	75	80	85	75

- Compute the composite (weighted average) rating for each location.
- Which site would you choose?
- Would you reach the same conclusion if the weights for operating cost and labour cost were reversed? Recompute as necessary and explain.

### SOLUTION:

FACTOR	WEIGHT	AKRON		BILOXI		CARTHAGE		DENVER	
		RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE
LABOR AVAILABILITY	0,15	90	13,5	80	12	90	13,5	80	12
TECH SCHOOL QTY	0,10	95	9,5	75	7,5	65	6,5	85	8,5
OPERATING COST	0,30	80	24	85	25,5	95	28,5	85	25,5
LAND+ CONST COST	0,15	60	9	80	12	90	13,5	70	10,5
INDUSTRIL INCENTIVES	0,20	90	18	75	15	85	17	60	12
LABOR COST	0,10	75	7,5	80	8	85	8,5	75	7,5
	1,00		81,5		80		87,5		76

FACTOR	WEIGHT	AKRON		BILOXI		CARTHAGE		DENVER	
		RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE
LABOR AVAILABILITY	0,15	90	13,5	80	12	90	13,5	80	12
TECH SCHOOL QTY	0,10	95	9,5	75	7,5	65	6,5	85	8,5
OPERATING COST	0,10	80	8	85	8,5	95	9,5	85	8,5
LAND+ CONST COST	0,15	60	9	80	12	90	13,5	70	10,5
INDUSTRIL INCENTIVES	0,20	90	18	75	15	85	17	60	12
LABOR COST	0,30	75	22,5	80	24	85	25,5	75	22,5
	1,00		80,5		79		85,5		74

**Exercise LOC 2:**

Böhler Refineries, headquartered in Bremen, must decide among three sites for the construction of a new oil processing centre. The firm has selected the six factors listed below as a basis for evaluation and has assigned rating weights from 1 to 5 for each factor and rated each location for each factor on a 1- to 100-point basis

FACTOR	FACTOR NAME	RATING WEIGHT
1	Proximity to port facilities	5
2	Power-source availability and cost	3
3	Workforce attitude and cost	4
4	Distance from Houston	2
5	Community desirability	2
6	Equipment suppliers in area	3

FACTOR	LOCATION A	LOCATION B	LOCATION C
1	100	80	80
2	80	70	100
3	30	60	70
4	10	80	60
5	90	60	80
6	50	60	90

- Which site will be recommended based on total weighted scores?
- If location B's score for proximity to port facilities was reset at 90, how would the result change?
- What score would location B need on proximity to port facilities to change its ranking?

**SOLUTION:**

Question a							
FACTOR	WEIGHT	LOC A		LOC B		LOC C	
		RAT	SCORE	RAT	SCORE	RAT	SCORE
PROXIMITY TO PORT	5,00	100	500	80	400	80	400
POWER SOURCE	3,00	80	240	70	210	100	300
WORKFORCE ATTITUDE	4,00	30	120	60	240	70	280
DISTANCE TO HOUSTON	2,00	10	20	80	160	60	120
COMMUNITY DESIRABILITY	2,00	90	180	60	120	80	160
EQUIPMENT SUPPLIERS	3,00	50	150	60	180	90	270
	19,00		1210		1310		1530

Location C is the preferred location

Question b

FACTOR	WEIGHT	LOC A		LOC B		LOC C	
		RAT	SCORE	RAT	SCORE	RAT	SCORE
PROXIMITY TO PORT	5,00	100	500	90	450	80	400
POWER SOURCE	3,00	80	240	70	210	100	300
WORKFORCE ATTITUDE	4,00	30	120	60	240	70	280
DISTANCE TO HOUSTON	2,00	10	20	80	160	60	120
COMMUNITY DESIRABILITY	2,00	90	180	60	120	80	160
EQUIPMENT SUPPLIERS	3,00	50	150	60	180	90	270
	19,00		1210		1360		1530

Response : it is worthless. Location C is still the preferred one.

Please note that Location B ratings in the factors of Power source, Workforce attitude and Equipment suppliers are rather low

Question c

FACTOR	WEIGHT	LOC A		LOC B		LOC C	
		RAT	SCORE	RAT	SCORE	RAT	SCORE
PROXIMITY TO PORT	5,00	100	500	100	500	80	400
POWER SOURCE	3,00	80	240	70	210	100	300
WORKFORCE ATTITUDE	4,00	30	120	60	240	70	280
DISTANCE TO HOUSTON	2,00	10	20	80	160	60	120
COMMUNITY DESIRABILITY	2,00	90	180	60	120	80	160
EQUIPMENT SUPPLIERS	3,00	50	150	60	180	90	270
	19,00		1210		1410		1530

Response: no matter how high is the rating in Proximity, this does not compensate the poor ratings in the other factors

**Exercise LOC 3:**

Ateliers de l'Atlantique, a French manufacturing company, must expand by building a second facility. The search has been narrowed down to four cities: Amiens (A); Bordeaux (B); Chinon (C); and Dijon (D). Factors, scores, and weights are as follows:

			<i>SCORES BY SITE</i>			
I	FACTOR	WEIGHT ( $W_i$ )	A	B	C	D
1	Labor quality	20	5	4	4	5
2	Quality of life	16	2	3	4	1
3	Transportation	16	3	4	3	2
4	Proximity to markets	14	5	3	4	4
5	Proximity to suppliers	12	2	3	3	4
6	Taxes	12	2	5	5	4
7	Energy supplies	10	5	4	3	3

- a) Using the factor-rating method, what is the recommended site for Ateliers's new facility?  
b) For what range of values for the weight (currently  $W_7 = 10$ ) does the site given as the answer to part (a) remain a recommended site?

**SOLUTION**

FACTOR	WEIGHT	LOC A		LOC B		LOC C		LOC C	
		RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE
LABOR QTY	20,00	5	100	4	80	4	80	5	100
QTY OF LIFE	16,00	2	32	3	48	4	64	1	16
TRANSPORTATION	16,00	3	48	4	64	3	48	2	32
ORO TO ARKETS	14,00	5	70	3	42	4	56	4	56
PROX TO SUPPLIERS	12,00	2	24	3	36	3	36	4	48
TAXES	12,00	2	24	5	60	5	60	4	48
ENERGY SUPPLIES	10,00	5	50	4	40	3	30	3	30
	100,00		348		370		374		330

FACTOR	WEIGHT	LOC A		LOC B		LOC C		LOC C	
		RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE
LABOR QTY	20,00	5	100	4	80	4	80	5	100
QTY OF LIFE	16,00	2	32	3	48	4	64	1	16
TRANSPORTATION	16,00	3	48	4	64	3	48	2	32
ORO TO ARKETS	14,00	5	70	3	42	4	56	4	56
PROX TO SUPPLIERS	12,00	2	24	3	36	3	36	4	48
TAXES	12,00	2	24	5	60	5	60	4	48
ENERGY SUPPLIES	10,00	5	50	4	40	3	30	3	30
	100,00		348		370		374		330

ENERGY SUPPLIES	5		323		350		359		315
	6		328		354		362		318
	7		333		358		365		321
	8		338		362		368		324
	9		343		366		371		327
	10		348		370		374		330
	11		353		374		377		333
	12		358		378		380		336
	13		363		382		383		339
	14		368		386		386		342
	15		373		390		389		345
	16		378		394		392		348
	17		383		398		395		351
	18		388		402		398		354
	19		393		406		401		357
	20		398		410		404		360

FOR WEIGHTS OF ENERGY SUPPLIES FACTOR FROM 5 UP TO 14, LOCATION C IS THE PREFERRED ONE. WEIGHTS OVER 14 MAKE B THE PREFERRED LOCATION

**Exercise LOC 4:**

The EU has made changes in airline regulation that dramatically affect major European carriers such as British International Air (BIA), KLM, Air France, Alitalia, and Swiss International Air. With ambitious expansion plans, BIA has decided it needs a second service hub on the continent to complement its large Heathrow (London) repair facility.

The location selection is critical, and with the potential for creating 4,000 new skilled blue-collar jobs, virtually every city in western Europe is actively bidding for BIA’s business.

After initial investigations by Holmes Miller, head of the Operations Department, BIA has narrowed the list to 9 cities. Each is then rated on 12 factors, as shown in the table below.

- a) Help Miller rank the top three cities that BIA should consider as its new aircraft servicing site.
- b) After further investigation, Miller decides that an existing set of hangar facilities for repairs is not nearly as important as earlier thought. If he lowers the weight of that factor to 30, does the ranking change?
- c) After Miller makes the change in part (b), Germany announces it has reconsidered its offer of financial incentives, with an additional €200 million package to entice BIA. Accordingly, BIA has raised Germany’s rating to 10 on that factor. Is there any change in top rankings in part (b)?

DATA FOR PROBLEM 8.25		LOCATION								
FACTOR	IMPORTANCE WEIGHT	ITALY			FRANCE			GERMANY		
		MILAN	ROME	GENOA	PARIS	LYON	NICE	MUNICH	BONN	BERLIN
Financial incentives	85	8	8	8	7	7	7	7	7	7
Skilled labor pool	80	4	6	5	9	9	7	10	8	9
Existing facility	70	5	3	2	9	6	5	9	9	2
Wage rates	70	9	8	9	4	6	6	4	5	5
Competition for jobs	70	7	3	8	2	8	7	4	8	9
Ease of air traffic access	65	5	4	6	2	8	8	4	8	9
Real estate cost	40	6	4	7	4	6	6	3	4	5
Communication links	25	6	7	6	9	9	9	10	9	8
Attractiveness to relocating executives	15	4	8	3	9	6	6	2	3	3
Political considerations	10	6	6	6	8	8	8	8	8	8
Expansion possibilities	10	10	2	8	1	5	4	4	5	6
Union strength	10	1	1	1	5	5	5	6	6	6

**SOLUTION:**

a)

PROBLEMA 8-25 A		ITALY						FRANCE						GERMANY					
FACTOR	WEIGHT	MILAN		ROME		GENOA		PARIS		LYON		NICE		MUNICH		BONN		BERLIN	
		RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE
FINANCIAL INCENTIV	85,00	8	680	8	680	8	680	7	595	7	595	7	595	7	595	7	595	7	595
SKILLED LABOUR	80,00	4	320	6	480	5	400	9	720	9	720	7	560	10	800	8	640	9	720
EXISTING FACILITY	70,00	5	350	3	210	2	140	9	630	6	420	5	350	9	630	9	630	2	140
WAGE RATES	70,00	9	630	8	560	9	630	4	280	6	420	6	420	4	280	5	350	5	350
COMPETITION FOR JC	70,00	7	490	3	210	8	560	2	140	8	560	7	490	4	280	8	560	9	630
EASE OF AIR TRAFIC A	65,00	5	325	4	260	6	390	2	130	8	520	8	520	4	260	8	520	9	585
REAL ESTATE COST	40,00	6	240	4	160	7	280	4	160	6	240	6	240	3	120	4	160	5	200
COMMUNIC LINKS	25,00	6	150	7	175	6	150	9	225	9	225	9	225	10	250	9	225	8	200
ATRAC RELOC EXECS	15,00	4	60	8	120	3	45	9	135	6	90	6	90	2	30	3	45	3	45
POLITICAL CONSID.	10,00	6	60	6	60	6	60	8	80	8	80	8	80	8	80	8	80	8	80
EXPANSION POSSIB	10,00	10	100	2	20	8	80	1	10	5	50	4	40	4	40	5	50	6	60
UNION STRENGTH	10,00	1	10	1	10	1	10	5	50	5	50	5	50	6	60	6	60	6	60
			3415		2945		3425		3155		3970		3660		3425		3915		3665

b)

PROBLEMA 8-25 B		ITALY						FRANCE						GERMANY					
FACTOR	WEIGHT	MILAN		ROME		GENOA		PARIS		LYON		NICE		MUNICH		BONN		BERLIN	
		RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE
FINANCIAL INCENTIV	85,00	8	680	8	680	8	680	7	595	7	595	7	595	7	595	7	595	7	595
SKILLED LABOUR	80,00	4	320	6	480	5	400	9	720	9	720	7	560	10	800	8	640	9	720
EXISTING FACILITY	70,00	5	350	3	210	2	140	9	630	6	420	5	350	9	630	9	630	2	140
WAGE RATES	70,00	9	630	8	560	9	630	4	280	6	420	6	420	4	280	5	350	5	350
COMPETITION FOR JC	70,00	7	490	3	210	8	560	2	140	8	560	7	490	4	280	8	560	9	630
EASE OF AIR TRAFIC A	65,00	5	325	4	260	6	390	2	130	8	520	8	520	4	260	8	520	9	585
REAL ESTATE COST	40,00	6	240	4	160	7	280	4	160	6	240	6	240	3	120	4	160	5	200
COMMUNIC LINKS	25,00	6	150	7	175	6	150	9	225	9	225	9	225	10	250	9	225	8	200
ATRAC RELOC EXECS	15,00	4	60	8	120	3	45	9	135	6	90	6	90	2	30	3	45	3	45
POLITICAL CONSID.	10,00	6	60	6	60	6	60	8	80	8	80	8	80	8	80	8	80	8	80
EXPANSION POSSIB	10,00	10	100	2	20	8	80	1	10	5	50	4	40	4	40	5	50	6	60
UNION STRENGTH	10,00	1	10	1	10	1	10	5	50	5	50	5	50	6	60	6	60	6	60
			3215		2825		3345		2795		3730		3460		3065		3555		3585

c)

PROBLEMA 8-25 C		ITALY						FRANCE						GERMANY								
FACTOR	WEIGHT	MILAN		ROME		GENOA		PARIS		LYON		NICE		MUNICH		BONN		BERLIN				
		RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE			
FINANCIAL INCENTIV	85,00	8	680	8	680	8	680	7	595	7	595	7	595	10	850	10	850	10	850			
SKILLED LABOUR	80,00	4	320	6	480	5	400	9	720	9	720	7	560	10	800	8	640	9	720			
EXISTING FACILITY	30,00	5	150	3	90	2	60	9	270	6	180	5	150	9	270	9	270	2	60			
WAGE RATES	70,00	9	630	8	560	9	630	4	280	6	420	6	420	4	280	5	350	5	350			
COMPETITION FOR JC	70,00	7	490	3	210	8	560	2	140	8	560	7	490	4	280	8	560	9	630			
EASE OF AIR TRAFIC A	65,00	5	325	4	260	6	390	2	130	8	520	8	520	4	260	8	520	9	585			
REAL ESTATE COST	40,00	6	240	4	160	7	280	4	160	6	240	6	240	3	120	4	160	5	200			
COMMNIC LINKS	25,00	6	150	7	175	6	150	9	225	9	225	9	225	10	250	9	225	8	200			
ATRAC RELOC EXECES	15,00	4	60	8	120	3	45	9	135	6	90	6	90	2	30	3	45	3	45		1-berlin	
POLITICAL CONSID.	10,00	6	60	6	60	6	60	8	80	8	80	8	80	8	80	8	80	8	80		2-bonn	
EXPANSION POSSIB	10,00	10	100	2	20	8	80	1	10	5	50	4	40	4	40	5	50	6	60		3-lyon	
UNION STRENGTH	10,00	1	10	1	10	1	10	5	50	5	50	5	50	6	60	6	60	6	60			
					3215		2825		3345		2795		3730		3460		3320		3810		3840	

## EXERCISE LOC 5

Marilyn Helm Retailers is attempting to decide on a location for a new retail outlet. The firm now has three alternatives: stay where it is but enlarge the facility; locate along the main street in nearby Newbury; or locate in a new shopping mall in Hyde Park. The company has selected the four factors listed in the following table as the basis for evaluation and has assigned weights as shown:

Factor	Factor description	Weight
1	Average community income	0.30
2	Community growth potential	0.15
3	Availability of public transportation	0.20
4	Labour availability, attitude, and cost	0.35

Helm has rated each location for each factor, on a 100-point basis. These ratings are given below:

Factor	Location		
	Present location	Newbury	Hyde Park
1	40	60	50
2	20	20	80
3	30	60	50
4	80	50	50

a) What should Helm do?

b) A new underground train station is scheduled to open across the street from the present location in about a month, so its third factor score should be raised to 40. How does this change your answer?

**SOLUTION:**



FACTOR	WEIGHT	PRESENT LOCATION		NEWBURY		HYDE PARK	
		RAT	SCORE	RAT	SCORE	RAT	SCORE
Average community income	0,30	40	12	60	18	50	15
Community Growth potential	0,15	20	3	20	3	80	12
Availability of public transportation	0,20	30	6	60	12	50	10
Labor availability, attitude and cost	0,35	80	28	50	17,5	50	17,5
	1,00		49		50,5		54,5

A) BEST LOCATION IS HYDE PARK

B)

FACTOR	WEIGHT	PRESENT LOCATION		NEWBURY		HYDE PARK	
		RAT	SCORE	RAT	SCORE	RAT	SCORE
Average community income	0,30	40	12	60	18	50	15
Community Growth potential	0,15	20	3	20	3	80	12
Availability of public transportation	0,20	40	8	60	12	50	10
Labor availability, attitude and cost	0,35	80	28	50	17,5	50	17,5
	1,00		51		50,5		54,5

Best location is still Hyde Park.

### EXERCISE LOC 6

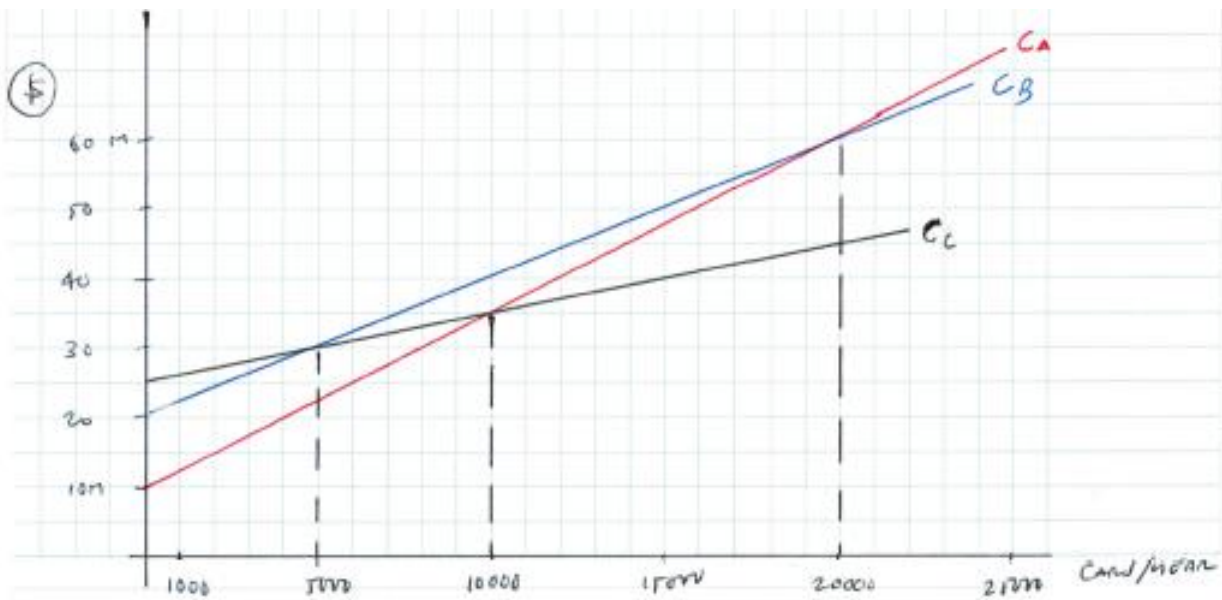
Hyundai Motors is considering three sites (A, B, and C) to locate a factory for its new car, the Hyundai Sport C150. The goal is to locate at a minimum-cost site, where cost is measured by the annual fixed plus variable costs of production. Hyundai Motors has gathered the following data:

Site	Annualised fixed cost	Variable cost per auto produced
A	\$10,000,000	\$2,500
B	\$20,000,000	\$2,000
C	\$25,000,000	\$1,000

The firm knows it will produce between 0 and 60,000 Sport C 150s at the new plant each year, but, so far, that is the extent of its knowledge about production volume.

- For what values of volume,  $V$ , of production, if any, is site C a recommended site?
- For what volumes is site A optimal?
- Over what range of volume is site B optimal? Why?

**SOLUTION:**



COST LOCATION A  $C_A = 10.000.000 + 2.500 \cdot \bar{x}$

COST LOCATION B  $C_B = 20.000.000 + 2.000 \cdot \bar{x}$

COST LOCATION C  $C_C = 25.000.000 + 1.000 \cdot \bar{x}$

$\bar{x} = \text{CARS/YEAR}$

COMPARISON A vs B  $C_A(x) = C_B(x) \rightarrow x = 20.000 \text{ CARS/YEAR}$

A vs C  $C_A(x) = C_C(x) \rightarrow x = 10.000 \text{ CARS/YEAR}$

B vs C  $C_B(x) = C_C(x) \rightarrow x = 5.000 \text{ CARS/YEAR}$

a) LOCATION C IS THE CHEAPEST FOR VOLUMES  $> 10.000 \text{ CARS/YEAR}$

b) SITE A IS OPTIMAL FOR VOLUMES  $0 - 10.000 \text{ CARS/YEAR}$

c) SITE B IS NOT RECOMMENDED

VOLUMES  $0 - 10.000$  : SITE A IS CHEAPER  
 $10.000 \rightarrow$  C IS CHEAPER  
 2

### EXERCISE LOC 7

A British hospital chain wishes to make its first entry into the US market by building a medical facility in the Midwest, a region with which its director, Doug Moodie, is comfortable because he obtained his medical degree at Northwestern University.

After a preliminary analysis, four cities are chosen for further consideration. They are rated and weighted according to the factors shown below:

Factor	Weight	City			
		Chicago	Milwaukee	Madison	Detroit
Costs	2.0	8	5	6	7
Need for a facility	1.5	4	9	8	4
Staff availability	1.0	7	6	4	7
Local incentives	0.5	8	6	5	9

a) Which city should Moodie select?

b) Assume a minimum score of 5 is now required for all factors, which city should be chosen?

**SOLUTION:**

QUESTION A : CHICAGO									
FACTOR	WEIGHT	CHICAGO		MILWAUKEE		MADISON		DETROIT	
		RAT	SCORE	RAT	SCORE	RAT	SCORE	RAT	SCORE
COSTS	2,00	8	16	5	10	6	12	7	14
NEED FOR A FACILITY	1,50	4	6	9	13,5	8	12	4	6
STAFF AVAILABILITY	1,00	7	7	6	6	4	4	7	7
LOCAL INCENTIVES	0,50	8	4	6	3	5	2,5	9	4,5
	5,00		33		32,5		30,5		31,5
QUESTION B : MILWAUKEE									

**EXERCISE LOC 8**

Peggy Lane Corp., a machine tool producer, wants to move to a larger site. Two locations have been identified: Bonham and McKinney. Bonham would have fixed costs of \$800,000 per year and variable costs of \$14,000 per standard unit produced. McKinney would have annual fixed costs of \$920,000 and variable costs of \$13,000 per standard unit. The finished items sell for \$29,000 each.

- a) At what volume of output would the two locations have the same profit?
- b) For what range of output would Bonham be superior (have higher profits)?
- c) For what range would McKinney be superior?
- d) What is the relevance of break-even points for these cities?

**SOLUTION:**

Profit location Bonham:  $P_B = 29 \cdot x - (14 \cdot x + 800) = (29 - 14) \cdot x - 800$

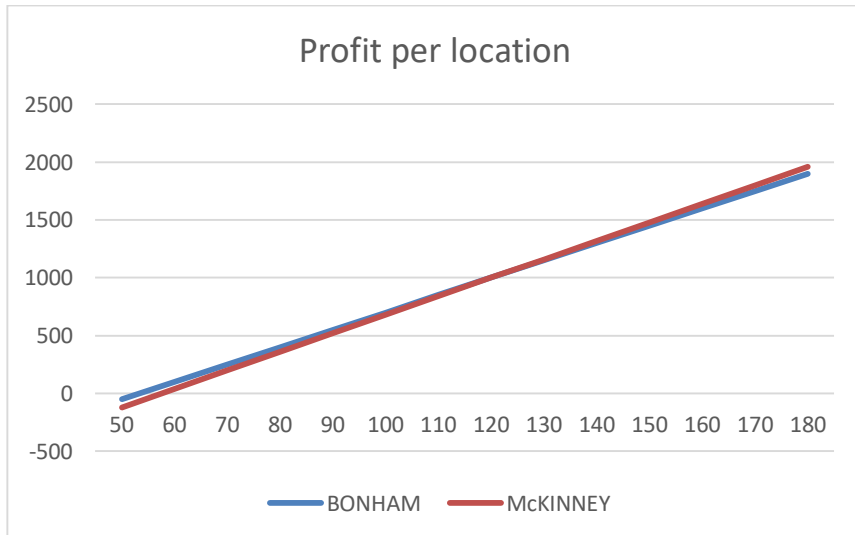
Profit location McKinney:  $P_M = 29 \cdot x - (13 \cdot x + 920) = (29 - 13) \cdot x - 920$

Comparison A vs B:

$P_B = (29 - 14) \cdot x - 800 = P_M = (29 - 13) \cdot x - 920 \rightarrow x = 120 \text{ units/year}$

Less than 120 units per year: Bonham; more than 120: McKinney

	50	60	70	80	90	100	110	120	130	140	150	160	170	180
BONHAM	-50	100	250	400	550	700	850	1000	1150	1300	1450	1600	1750	1900
McKINNEY	120	40	200	360	520	680	840	1000	1160	1320	1480	1640	1800	1960



### EXERCISE LOC 9

María Rodríguez, a graduate in business administration and management, has been awarded the first prize (two million euros) of the national lottery. She has decided to invest part of her prize money in the opening of a candy store. For the location of the store, Maria analyses the presence of schools in the area and tries to minimise the distance travelled by pupils from the different schools, since the short break times mean that the students cannot travel far from school. The weighting factor used as a reference is the number of hundreds of pupils in each school.

The table shows the data necessary to solve the problem.

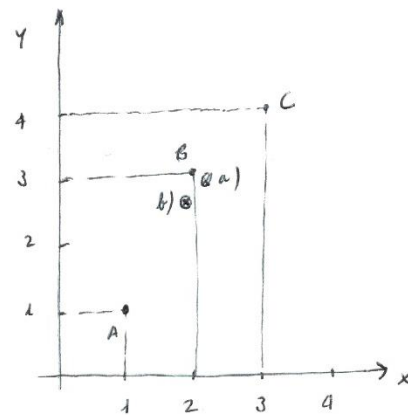
	Nº of pupils	Location
School A	600	(1,1)
School B	300	(2,3)
School C	900	(3,4)

- Find out the optimal location
- If by next year, School A is to be converted in a mixed gender school and would have 1000 pupils, would your solution remain the same?

### SOLUTION:

6.5

SCHOOL	PUPILS	LOCATION
A	600/1000	1, 1
B	300	2, 3
C	900	3, 4



a) LOCATION of SHOP

$$x = \frac{600 \cdot 1 + 300 \cdot 2 + 900 \cdot 3}{600 + 300 + 900} = \frac{3900}{1800} = 2.16$$

$$y = \frac{600 \cdot 1 + 300 \cdot 3 + 900 \cdot 4}{600 + 300 + 900} = \frac{5100}{1800} = 2.81$$

b) LOCATION IF A = 1000 PUPILS

$$x = \frac{1000 \cdot 1 + 300 \cdot 2 + 900 \cdot 3}{1000 + 300 + 900} = \frac{4300}{2200} = 1.95$$

$$y = \frac{1000 \cdot 1 + 300 \cdot 3 + 900 \cdot 4}{1000 + 300 + 900} = \frac{5500}{2200} = 2.50$$