

TOPIC 12: FACILITY LAYOUT AND LOCATION

Solutions to Practice Problems

1. Because each item has different area requirements, we must first obtain the ratio of trips to block spaces.

<u>Item</u>	<u>Trips</u>	<u>Area Needed</u> <u>(blocks)</u>	<u>Ratio</u>	<u>Rank</u>
A	60	10	$60/10 = 6$	5
B	72	4	$72/4 = 18$	4
C	300	5	$300/5 = 60$	3
D	240	3	$240/3 = 80$	1
E	77	1	$77/1 = 77$	2

Therefore, item D will be put closest to the dock, followed by items E, C, B and A, respectively.

2. We first obtain the ratio of trips to block spaces as follows:

<u>System Package</u>	<u>Trips</u>	<u>Area Needed</u> <u>(blocks)</u>	<u>Ratio</u>	<u>Rank</u>
PS2	50	10	$50/10 = 5$	3
Game Cube	22	8	$22/8 = 2.75$	5
X-box	40	12	$40/12 = 3.33$	4
Gameboy Color	21	3	$21/3 = 7$	2
Gameboy Advance	58	5	$58/5 = 11.6$	1

Therefore, Gameboy Advance will be put closest to the dock, followed by Gameboy Color, PS2, X-box, and Game Cube, respectively.

3. Note: You may choose any equal weight (e.g., 1 unit, 10 units, 88 units) here, as long as you divide by the corresponding total weights. The solution will be same since the weights will be cancelled out. Suppose we choose a units (a unknown), we have

$$X^* = \frac{\sum_i x_i w_i}{\sum_i w_i} = \frac{2a + 4a + 7a + 11a}{a + a + a + a} = \frac{24a}{4a} = 6$$

$$Y^* = \frac{\sum_i y_i w_i}{\sum_i w_i} = \frac{3a + 6a + 3a + 5a}{a + a + a + a} = \frac{17a}{4a} = 4.25$$

Therefore, coordinates (6, 4.25) should be chosen as the location of the warehouse.

$$4. \quad X^* = \frac{\sum_i x_i w_i}{\sum_i w_i} = \frac{5(100) + 10(50) + 6(75) + 1(10) + 4(30)}{100 + 50 + 75 + 10 + 30} = \frac{1580}{265} = 5.96$$

$$Y^* = \frac{\sum_i y_i w_i}{\sum_i w_i} = \frac{7(100) + 10(50) + 8(75) + 9(10) + 8(30)}{100 + 50 + 75 + 10 + 30} = \frac{2130}{265} = 8.04$$

Therefore, coordinates (5.96, 8.04) should be chosen as the location of the central manufacturing point.

5. The distances in this case are rectilinear.

	Customer 1	Customer 2	Customer 3	
	100	500	200	
Site	(10, 30)	(50, 10)	(20, 20)	Total Load-Distance
A: (30, 20)	30	30	10	20,000
B: (15, 30)	5	55	15	31,000
C: (50, 25)	45	15	35	19,000

Sample calculations:

From Site A at (30, 20) to Customer 1 at (10, 30), the rectilinear distance = $|30 - 10| + |20 - 30| = 30$.

Total load-distance for Site A at (30, 20) = $100(30) + 500(30) + 200(10) = 20,000$.

Conclusion: Site C should be chosen.

6. If the distances are Euclidean, we have the following.

	Customer 1	Customer 2	Customer 3	
	100	500	200	
Site	(10, 30)	(50, 10)	(20, 20)	Total Load-Distance
A: (30, 20)	22.36	22.36	10.00	15,416
B: (15, 30)	5.00	40.31	11.18	22,891
C: (50, 25)	40.31	15.00	30.41	17,613

Distance Calculation Example:

From Site A (30, 20) to Customer 1 at (10, 30), the Euclidean distance = $\sqrt{(30-10)^2 + (20-30)^2} = \sqrt{500} = 22.36$.

Total load-distance for Site A at (30, 20) = $100(22.36) + 500(22.36) + 200(10.00) \approx 15,416$.

Conclusion: Site A should be chosen.