

IE 102 Spring 2017

Study Set 1

Question 1: “Waste management is the generation, prevention, characterization, monitoring, treatment, handling, reuse and residual disposition of solid wastes. There are various types of solid waste including municipal (residential, institutional, commercial), agricultural, and special (health care, household hazardous wastes, sewage sludge).” Specific to the waste system, the responsibility of the metropolitan municipality is the treatment and disposal activities. Storage, collection, and transportation of the solid waste to designated locations (currently landfill areas) are the responsibilities of the district municipalities.

Current practice in performing the required set of activities of the waste management system is carried out in the traditional labor-intensive way. There is a combination of storage practices, including regular waste containers, ad hoc containers, plastic bags, buckets, etc. The storage mode is without separation, i.e. no formal separation of paper, plastic or glass is performed at the source. Additionally, fuel refuses are not collected separately in most of the regions of the cities. The collection of waste is performed by collection trucks, almost all of the equipped with a packing facility. No transfer stations are available and the collected waste is transported by the collection trucks to the designated landfill areas. The collected waste is landfilled after a rough separation process performed in the landfill area. The landfill process is not sanitary in the real sense, but some efforts are made to make the landfill area a better one.

- a) Identify how the process of collecting and transporting solid waste to landfill area. Itemize elements of the process, specify the resources used; and make sure that you have described them in detail. Use standard process chart elements.
- b) Based on the text, what are the typical decisions to be made by a district municipality?
- c) A reasonable process chart to follow solid waste is supplied in the below table:

Activity Number	Process	Description	Details
1	S	Households store solid waste at home	Storage bags are used
2	D	Bags wait at home	There might be a designated time to take the bags out
3	T	Bags are taken out to the street	No equipment is used.
4	S	Bags are stored in storage equipment at the street.	Container is a storage equipment
5	T	Garbage is taken out from the containers before the estimated truck arrival time	Manual
6	D	Garbage bags waits at the street the arriving collection truck	
7	O	Collection truck arrives and bags are collected	Manual
8	O	Truck moves and collect bags until the designated area is covered	Operations 1-6 is repeated for all households Truck repeats Operation 7
9	T	Truck travels to the landfill area	

10	O	Truck dumps solid waste to the landfill area	
11	S	Solid waste is stored in the landfill area	Solid Waste spends years in the landfill area

Transfer Station – A facility where solid waste is transferred from collection vehicles to larger-capacity trucks for the purposes of utilizing collection vehicles more for collection purposes and using less expensive and larger capacity trucks for transporting waste longer distances to landfill areas.

Describe how Transfer Stations will change this chart. Only rewrite the activities that will change – simply use the “Activity Number” if the same activity will stay.

Question 2: Consider a typical supplier selection problem for a manufacturer. For a certain component only one supplier should be selected. There are three criteria that can be used: **Serviceability**, **Supply Capability** and **Quality**.

Serviceability usually refers to factors that measure the supplier’s ability to satisfy the manufacturer’s requirements not only timely, but at the desired levels of service. The following are the related performance measures:

Lead-time duration (in days); Meet the desired lead-time (% of cases); Number of orders per year; Customer satisfaction of supplier’s other customers (measured in a scale of 0-100; obtained by interviews); Market share (% of the suppliers’ market)

Supply Capability usually refers to the capabilities of the supplier with respect to future possible needs of the manufacturer, which is a consideration to have a long relationship with the supplier.

The following are the related performance measures:

Production flexibility (in number of days needed to switch production form one item to the next); Multi-item production capability (in number of different items that can be requested in parallel); New-product development/production capability (in number of successful previous projects)

Quality usually refers to supplier’s system of detecting errors, as well as the efficiency in solving problems that may occur after sales. The following are the related performance measures:

Quality assurance system (whether IS9001 exists or not), Return penalty to be paid to the manufacturer as a % of item cost; After-sales service level (number of days to react to a problem)

- a) For each of the above performance measure, determine the values which are preferable (such as larger value is preferable, and so on). Please make use of **the problem statement given above ONLY**.

- b) The next table is supplied as the data you may want to use for selecting one of the four possible suppliers. Propose and explain the ranges you want to use for each performance measure.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Lead-time duration	15 days	17 days	16 days	14 days
Meet the desired lead-time	91%	80%	85%	90%
Number of orders per year	15	12	16	13
Customer satisfaction	42	48	52	55
Market share	12%	18%	19%	15%
Production flexibility	20 days	27 days	16 days	18 days
Multi-item production capability	2 products	4 products	3 products	1 product
New-product development ...	1 project	2 projects	1 project	1 project
Quality assurance system	ISO9001	ISO9001	ISO9001	None
Return penalty	12%	3%	1%	4%
After-sales service level	3 days	6 days	2 days	5 days

- c) Then using ranges proposed in part (b) fill the table below.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Lead-time duration				
Meet the desired lead-time				
Number of orders per year				
Customer satisfaction				
Market share				
Production flexibility				
Multi-item production capability				
New-product development ...				
Quality assurance system				
Return penalty				
After-sales service level				

- d) Additionally, you have decided to give the following weights for the problem. Can you suggest the value for a in the table? Can you determine the weight for each criterion?

Criterion	Performance Measure	Weight
Serviceability	Lead-time duration	0.06
	Meet the desired lead-time	0.10
	Number of orders per year	0.16
	Customer satisfaction	a
	Market share	0.04
Supply Capability	Production flexibility	0.04
	Multi-item production capability	0.13
	New-product development ...	0.08
Quality	Quality assurance system	0.15
	Return penalty	0.04
	After-sales service level	0.06

- e) By using the common unit scores found in part (c) and the weights found in part (d), find the best supplier. To calculate the total weighted score, use the table below.

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Lead-time duration				
Meet the desired lead-time				
Number of orders per year				
Customer satisfaction				
Market share				
Production flexibility				
Multi-item production capability				
New-product development ...				
Quality assurance system				
Return penalty				
After-sales service level				
TOTAL SCORE				

Question 3: A logistics company has an open facility (**Facility I**) to serving eight cities (**Cities $\in \{1,2,3,4,5,6,7,8\}$**). Suppose that, the company has **\$200,000 budget** that can be dedicated for opening new facilities so that total distance from facilities to the cities they serve is improved. The company would like to spend this **\$200,000** as wise as possible. They have spotted four other locations that can be a candidate for opening an additional facility (**Candidate Facilities $\in \{II,III,IV,V\}$**). The cost of opening each facility is given on the following table:

Facility Number	II	III	IV	V
Opening Cost	\$60,000	\$90,000	\$190,000	\$80,000

The distance matrix of Facilities vs. Cities is provided below:

	1	2	3	4	5	6	7	8
I	839	277	271	1049	557	489	745	1040
II	667	500	792	620	326	466	290	809
III	900	327	326	1264	752	550	992	1112
IV	490	256	655	685	184	258	413	667
V	552	292	704	1058	572	322	905	764

- Determine all options for open facilities without exceeding the budget. Find the best one among them. Show your work explicitly.
- Suppose that the company can close **Facility I** while having an additional budget of \$50,000. Can you find a lower cost option than part a? Show your work explicitly.