Optimization Modeling – Analytical Decision Making

Problem 1: Sitting Sales Representatives

A large drug company must determine how many sales representatives to assign to each of four sales districts. The cost of having *n (n>0)* representatives in a district is *88,000+80,000n* dollars per year, and you only pay 88,000 fixed cost if there is at least one sales representative at that district.

If a sales rep is based in a given district, the time it takes to complete a call on a doctor is that given in the following table, where times are in hours:

Actual Sales Call District				
Rep's Base District	**1**	**2**	**3**	**4**
1	1	4	5	7
2	4	1	3	5
3	5	3	1	2
4	7	5	2	1

Each sales rep can work up to 160 hours per month. Each month a certain number of calls, given in the following table, must be made in each district.

	Number of calls
District 1	50
District 2	80
District 3	100
District 4	60

Determine how many representatives should be assigned to each district.

Problem 2: The Wild Turkey Company

The Wild Turkey Company produces two types of turkey cutlets for sale to fast-food restaurants.

Each type of cutlet consists of white meat and dark meet. Cutlet 1 sells for $4 per pound and must consist of at least 70% white meat. Cutlet 2 sells for $3 per pound and must consist of at least 60% white meat. At most, 5000 pounds of cutlet 1 and 3000 pounds of cutlet 2 can be sold.

The two types of turkey used to manufacture the cutlets are purchased from the Gobble-Gobble Turkey Farm. Each type 1 turkey costs $10 and yields 5 pounds of white meat and 2 pounds of dark meat. Each type 2 turkey costs $8 and yields 3 pounds of white meat and 3 pounds of dark meat.

Gobble-Gobble cannot sell less than 100 of type 1 turkey, i.e. if Wild Turkey decides to purchase any type 1 turkey, it should purchase at least 100.

Determine how to maximize Wild Turkey's profit.

Problem 3: Kingston Manufacturing

Kingston Manufacturing produces heads for engines used in the manufacture of trucks. The production line is highly complex and measures 500 meters in length. Two types of engine heads are produced on the line: the P-Head and the H-Head. The P-Head is used in heavy duty trucks and the H-head is used in smaller trucks. Because only one type of head can be produced at a time, the line is either set up to manufacture the P-Head or the H-Head, but not both. Changeovers from producing one type to the other are made on weekends and cost $500. The line has capacity to produce the P-Head at 100 units per week and the H-Head at 80 units per week.

Kingston Manufacturing has just shut down for the week and the line has been producing the P-Head. The manager wants to plan production and changeovers for the next eight weeks. Currently Buckeye has an inventory of 125 P-Heads and 143 H-Heads. Inventory carrying costs are charged at an annual rate of 19.5% of the value of inventory. The production cost for the P-Head is $225 and for the H-Head is $310. The objective in developing a production schedule is to minimize the sum of production cost, inventory carrying cost and changeover costs.
Kingston Manufacturing has received the following requirements schedule from its customer (an engine assembler) for the next nine weeks. Safety stock requirements are such that week-ending inventory must provide for at least 80% of next week's demand.

You should prepare a production and changeover schedule report for the Kingston Manufacturing management to minimize total costs for the next eight weeks.

	Product Demand	
Week	P-Head	H-Head
1	55	38
2	55	38
3	44	30
4	0	0
5	45	48
6	45	48
7	36	58
8	35	57
9	35	58

Problem 4: Assigning Technicians to Shifts

You are planning the staffing of maintenance technicians at a printing plant which operates on three shifts. You can use up to 8 possible technicians, each of whom can be assigned to at most one shift. The costs of assigning the technicians and their certified categories of competency are as follows:

	Shift 1	Shift 2	Shift 3	Certified in Category			
Technician	**Cost**	**Cost**	**Cost**	1	2	3	4
1	$ 280	$ 290	$ 300	X	X	--	X
2	$ 300	$ 330	$ 350	--	X	X	X
3	$ 270	$ 280	$ 290	--	--	X	X
4	$ 180	$ 190	$ 200	X	--	--	--
5	$ 175	$ 160	$ 185	--	X	--	--
6	$ 225	$ 225	$ 225	--	X	--	X
7	$ 295	$ 295	$ 315	X	X	X	--
8	$ 305	$ 350	$ 320	--	X	--	X

For example, it would cost $280 to assign technician 1 to shift 1, $290 to assign her to shift 2, and $300 to assign her to shift 3, and she is certified in categories 1, 2, and 4. More than one technician may be assigned to each shift. In each category, you need at least one certified technician assigned to each shift.

Determine the least expensive way to meet your maintenance technician staffing needs.