TD1

Exercise 1

A manufacturing company produces two types of products, A and B, using two machines, X and Y. Each unit of A requires 2 hours on machine X and 1 hour on machine Y, while each unit of B requires 1 hour on machine X and 3 hours on machine Y. Machine X is available for 40 hours, and machine Y is available for 30 hours per week. The profit per unit of A is 8000 DZD, and for B, it is 10000 DZD.

Formulate the problem of determining the optimal production quantities to maximize profit.

Exercise 2

The company manufactures 2 types of wooden toys: trucks and trains.

The price of a piece of truck is 3000 DZD, of a piece of train 5000 DZD. The wood cost for the truck is 900 DZD, whereas for the train 1500 DZD.

The truck requires 1 hour of carpentry labour and 1 hour of finishing labour (assembling and painting). The train requires 2 hours of carpentry labour and 1 hour of finishing labour.

Worth of carpentry labour is 300 DZD per hour, worth of finishing labour is 200 DZD per hour.

Each month, the company has 5000 available hours of carpentry labour and 3000 hours of finishing labour.

Demand for trains is unlimited, but at least 2000 trucks are bought each month.

The company managers want to maximize monthly profit.

Formulate the problem.

Exercise 3

A distribution company has three warehouses (W1, W2, W3) and four retail stores (S1, S2, S3, S4). The company needs to determine the optimal shipping plan to minimize transportation costs while meeting the demand at each store. The shipping costs per unit (in Dinars) from each warehouse to each store, along with the available supply at each warehouse and the demand at each store, are as follows:

Shipping Costs (per unit, in Dinars)				
	S1	S2	S3	S4
W1 to	1000	800	600	900
W2 to	900	700	500	600
W3 to	800	600	400	700

Warehouse Supplies (available units)	
W1	150 units
W2	200 units
W3	100 units

Store Demands (required units)	
S1	100 units
S2	120 units
S3	80 units
S4	150 units

- Your task is to formulate a linear programming problem to find the optimal shipping quantities from each warehouse to each store, minimizing the total transportation costs while ensuring that the supply at each warehouse meets the demand at each store.

Exercise 4

We are given a set of items, each with a weight w_i and a value v_i, and a knapsack with a maximum capacity W. The goal is to determine the maximum value that can be obtained by selecting a subset of the items to fit into the knapsack without exceeding its capacity.

- Formulate the problem.