

A cargo plane has three compartments for storing cargo: front, center and rear. These compartments have the following limits on both weight and space:

Compartment	Weight capacity (tons)	Space capacity (cubic meters)
Front	10	6800
Center	16	8700
Rear	8	5300

Furthermore, the weight of the cargo in the respective compartments must be the same proportion of that compartment's weight capacity to maintain the balance of the plane.

The following four cargoes are available for shipment on the next flight:

Cargo	Weight (tons)	Volume (cubic meters/ton)	Profit (\$/ton)
C1	18	480	310
C2	15	650	380
C3	23	580	350
C4	12	390	285

Any proportion of these cargoes can be accepted. The objective is to determine how much (if any) of each cargo C1, C2, C3 and C4 should be accepted and how to distribute each among the compartments so that the total profit for the flight is maximized.

The Manchester Herald newspaper wants to improve its advertising strategy for acquiring new subscriptions in the month of April. The Herald can advertise on TV, through telemarketing, radio and on the internet. TV advertising costs \$1000 per ad, telemarketing costs \$300 per hour of telemarketing, radio costs \$200 per ad, and internet advertising costs \$20 per day. One TV ad generates 100 new subscribers, an hour of telemarketing generates 80 new subscribers, one radio ad generates 16 new subscribers, and one day of internet advertising generates 1 new subscriber. The Herald wants to maximize the number of new subscribers but does not want to pay more than \$5 per new subscriber. Also, the Herald wants to have at least 20 days of internet advertising, 2 TV ads, and 4 radio ads, but no more than 10 hours of telemarketing per month. Assuming divisibility of all of the relevant units, formulate this problem as a linear program.

A canning company operates two canning plants. The growers are willing to supply fresh fruits in the following amounts:

S1: 200 tons at \$11/ton

S2: 310 tons at \$10/ton

S3: 420 tons at \$9/ton

Shipping costs in \$ per ton are:

	To:	Plant A	Plant B
From: S1		3	3.5
S2		2	2.5
S3		6	4

Plant capacities and labor costs are:

	Plant A	Plant B
Capacity	460 tons	560 tons
Labor cost	\$26/ton	\$21/ton

The canned fruits are sold at \$50/ton to the distributors. The company can sell at this price all they can produce.

The objective is to find the best mixture of the quantities supplied by the three growers to the two plants so that the company maximizes its profits.

The production manager of a chemical plant is attempting to devise a shift pattern for his workforce. Each day of every working week is divided into three eight-hour shift periods (00:01-08:00, 08:01-16:00, 16:01-24:00) denoted by night, day and late respectively. The plant must be manned at all times and the minimum number of workers required for each of these shifts over any working week is as below:

	Mon	Tues	Wed	Thur	Fri	Sat	Sun
Night	5	3	2	4	3	2	2
Day	7	8	9	5	7	2	5
Late	9	10	10	7	11	2	2

The union agreement governing acceptable shifts for workers is as follows:

1. Each worker is assigned to work either a night shift or a day shift or a late shift and once a worker has been assigned to a shift they must remain on the same shift every day that they work.
2. Each worker works four consecutive days during any seven day period. In total there are currently 60 workers.

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Formulate the manager's problem as a linear program.