LP Practice

Question 1

Fender guitars recently released the American Professional II series of guitars – this represents the mid-tier of the American-made instruments. The lowest tier of the American series is the American Perform and the highest tier is the Ultra.

Average profits are as follows:

Performer: 1200
Professional II: 1300
Ultra: 1400

Given the shocks to global supply chains, materials are in short supply. Every guitar in this series requires the following components:

1 body blank, 1 neck blank, 1 tuner set, 1 electronic set, 1 bridge set

All guitars use the same body and neck blanks. The Professional II and Ultra use the same electronics, bridges, and tuners. The Performer uses different electronics, bridges, and tuners than the others. Currently, Fender has 1500 neck and body blanks each. Fender also has 500 tuner sets, electronic sets, and bridge sets for the Professional II and Ultra series. They also have 1000 tuner, electronic, and bridge sets for the Performer series. Most of the demand occurs at the upper and lower series, but Fender knows that they need at least 200 Professional IIs. How should Fender maximize profits for these 3 different series?

Question 2

You like making money? I thought so! Let's imagine that each of the following investment strategies has some type of yearly ROI percent, assessed risk factor, and terms of investment in years:

Table 1:

	Strategy	ROI	Risk	Term
1	Blue chip stocks	12	2	4
2	Bonds	10	1	8
3	Growth stocks	15	3	2
4	Speculation	25	4	10
5	Cash	0	0	0

We want to maximize the return, but our risk should not exceed 2.5, we should not exceed 6 years of investment, and we need at least 15% of our portfolio to be in cash. What proportion should be invested in each type?

Question 3

You think "business" is the only place that uses optimization? Let's check out an example from medicine. When someone is getting radiation, there are some goals:

1. Destroy the tumor
2. Minimize normal tissue damage
3. Avoid organs

While this is done with a few hundred radiation beams, let's try to model it with 2.

We have the following cell types:

- normal tissue (n; what should not be damaged)
- critical tissue (c; think important organ tissue)
- target tissue (t; bad tissue)
- target center (tCenter; the middle of the bad tissue)

Table 2:

	area	beam1	beam2	rules
1	n	0.400	0.500	minimize
2	c	0.300	0.100	<= 2.8
3	t	0.500	0.500	== 6
4	tCenter	0.600	0.500	>= 6

Question 4

You need a team and you have a budget of **objective function value from question 1**. You need to get as many people on your team as possible. You need at least 3 stats people and at most 3 utility people. Given their intense dislike for each other, you can't have Seth and Sharif on the same team.

Seth: utility (150K)
Sharif: utility (150K)
Martin: utility (150K)
David: utility (150K)
Brandon: utility (150K)
John: utility (250K)

Francis: stats (150K)
Huy: stats (150K)
Hong: stats (250K)
Zifeng: stats (250K)
Junghee: stats (250K)
Maggie: stats (250K)
Ken: stats (350K)

Who are you taking?

Question 5

Just down the road from Notre Dame is Elkhart – the World's RV Capital! While they might not admit it, most of the manufactures use common components. Thor, Jayco, and Fleetwood all get their engines from 1 of 2 Cummins Engine plants. The following table is on the shipping department supervisor's desk.

Help ship the engines where they are needed, but do it as cheaply as you can.

Table 3:

	Engine_Plants	Thor_shipping	Jayco_shipping	Fleetwood_shipping	RVs_Needed
1	EP_1	40	30	20	300
2	EP_2	14	25	35	300
3	RVs_Needed	300	35	400	400