

## **IE 2001: OPERATION RESEARCH**

### *Homework Assignment 1: (Very!) Simple LP Models*

(Due: January 23, 2020)

Please read Chapter 1 and also start to read Chapter 3 (you may skip Sections 3.2 and 3.3 for now). Then answer the following LP modeling questions – **I only want the model formulation; don't worry about solving anything yet.** These are very simple exercises that will allow you to get a feel for how you should go about building mathematical models. Next week, you will be assigned more challenging modeling exercises!

**Make sure you clearly and completely define all of your decision variables.**

1. OMC produces two models of computers: Orange & Tangerine. There are three critical resources: disk drives, assembly labor and quality assurance labor. Next quarter OMC hopes to have 20,000 disk drives, 32,000 hours of labor in assembly and 88,000 hours of labor in QA. Each Orange contributes \$900 to profits, and needs 2 disk drives while using 4 hours of assembly and 2 hours of QA, while each Tangerine contributes \$600 to profits, and needs 1 disk drive while using 1 hour of assembly and 7 hours of QA. Formulate a linear program to optimize production for the next quarter. State any assumptions you make.
2. A company manufactures three chemicals, A, B and C using two production lines. Running Line 1 for an hour costs \$4,000 and yields 3 units of A, 1 unit of B and 1 unit of C, while running Line 2 for an hour costs \$1000 and yields 1 unit of A and 1 unit of B. To meet customer demands, at least 10 units of A, 5 units of B and 3 units of C must be produced each day. Formulate a linear program to optimally meet daily demand.
3. Waste from three different factories along a river can be processed to reduce the amount of two different types of pollutants that are being released into the river. If the goal is to ensure that the total reduction in the amount of pollutant A in the river is at least 30 tons and pollutant B is at least 40 tons, formulate a linear program to determine how this can be done at minimum cost. Use the information in the table below.

Factory	Processing cost per ton of waste	Reduction in pollutant A per ton of processed waste	Reduction in pollutant B per ton of processed waste
1	\$15	0.10 tons	0.45 tons
2	\$10	0.20 tons	0.25 tons
3	\$20	0.40 tons	0.30 tons

4. Question 8, page 114 of the text (Walnut Orchard).