APS 502 Computational Project #1

Instructions: This is an individual assignment. For each optimization model below you need to (1) formulate the model by hand (typed is better) with all variables defined and the model objective and constraints fully written out and (2) print out the MATLAB file that contains the data (e.g. through the vectors/matrices) and call to *linprog* used to compute the model in MATLAB and the output from calling *linprog* that shows the optimal values for the variables and objective function value.

Do not just dump the MATLAB file, comment it and highlight the optimal values. You must use MATLAB linprog function but you can call the function from python in which case you must print out your python code. Your project should be contained in a single pdf file (DO NOT MAKE THIS FILE TOO LARGE) and when you send me the file via e-mail (rkwon@mie.utoronto.ca) MAKE THE SUBJECT OF YOUR E-MAIL exactly as **APS 502 Computational Project 1. (I will not accept an e-mail that contains a link to your assignment, you must send me the assignment directly). Write your full legal name and student number on your assignment. Due Nov. 6 by 5PM (EST).** Late assignments will incur penalty.

Problem 1

A bond portfolio manager has $100,000 to allocate to two different bonds; a corporate bond and a government bond. These bonds have the following yield, risk level, and maturity:

Bond	Yield	Risk Level	Maturity
Corporate	4%	2	3 years
Government	3%	1	4 years

The portfolio manager would like to allocate the funds so that the average risk level of the portfolio is at most 1.5 and the average maturity is at most 3.6 years. Any amount not invested in the bonds will be kept in a cash account that is assumed to generate no interest and does not contribute to the average risk level or maturity. In other words, assume cash has zero yield, zero risk level, and zero maturity.

How should the manager allocate funds to the two bonds to maximize yield? Assume that the manager can only buy bonds i.e. selling bonds is prohibited. You can assume that the unit price of each bond is $1 (one dollar).

Formulate the portfolio managers problem as a linear program and solve using MATLAB.

Problem 2

Part 1

Formulate a linear programming model and solve using MATLAB to find the lowest-cost dedicated bond portfolio that covers the stream of liabilities given in the table below (allow cash to be carried forward at no-interest):

Date	1	2	3	4	5	6
Required	500	200	800	400	700	900

with the set of bonds below:

Bond	1	2	3	4	5	6	Price	Rating
1	10	10	10	10	10	110	108	B
2	7	7	7	7	7	107	94	B
3	8	8	8	8	8	108	99	B
4	6	6	6	6	106		92.7	B
5	7	7	7	7	107		96.6	B
6	6	6	6	106			95.9	B
7	5	5	5	105			92.9	A
8	10	10	110				110	A
9	8	8	108				104	A
10	6	6	106				101	A
11	10	110					107	A
12	7	107					102	A
13	100						95.2	A

Part 2

Now consider a version of the problem where at most 50% of the bond portfolio's value (value is in dollars) can be in bonds rated B. Solve this model using MATLAB and compare with optimal bond portfolio from Part 1.