

Due Date: 04/09/2025

Instructions: Please follow the guideline in *Assignments* section of the syllabus. To get full credit, you must show all your work. While submitting your homework, you need to submit 1) a document summarizing your solutions (the math programming models, calculations and/or the outputs of the codes) and 2) all codes as separate files (including .dat, .mod, .run and .out files). Each problem is 25 points. Upload your homework to canvas as a soft copy with the codes or handwritten calculations.

1.
 - (a) Use AMPL to model and solve the EV 2-variable example 1.2.1.
 - (b) Use AMPL to model and solve the EV 3-variable example 1.4.1.
 - (c) Change the required hours of electric wiring and assembly for the hybrid car to be 10 hr. Compare the objective value with 1(b).
2.
 - (a) Write an AMPL model for the investment example 1.5.1.
 - (b) Change the investment example 1.5.1 with the cash availability for years 0, 1, and 2 to be 50, 10, and 10 million, respectively. Solve the model by AMPL and give the solutions and objective value.
 - (c) Change the investment example 1.5.1 with the cash requirement of year 2 for the five projects to be 6, 12, 20, 25, and 24, respectively. Solve the model by AMPL and give the solutions and objective value.
3.
 - (a) Check if the following solutions are feasible to the original EV 2-variable example 1.2.1.
 - i. (EV production quantity, GC production quantity) = (10, 20)
 - ii. (EV production quantity, GC production quantity) = (50, 50)
 - iii. (EV production quantity, GC production quantity) = (70, 20)
 - (b) Check if the following solutions are feasible to the original investment example 1.5.1.
 - i. $(x_1, x_2, x_3, x_4, x_5) = (1.1, 0.3, 0.1, 0.4, 0.6)$
 - ii. $(x_1, x_2, x_3, x_4, x_5) = (0.5, 0.5, 0.3, -0.3, 0.5)$
 - iii. $(x_1, x_2, x_3, x_4, x_5) = (0.5, 0.2, 0, 0.1, 0.1)$
4. My diet requires that all the food I eat come from one of the four basic food groups. Each day I must eat at least 1000 calories, 1.5 oz of sugar, 2.5 oz of fat, and 2 oz of protein. The nutrient content of the food groups mentioned above is summarized in the table below.
 - (a) Formulate a linear programming model that can be used to minimize the daily cost.
 - (b) Solve the model in AMPL.

Type of Food	Cost (\$ per oz)	Calories (per oz)	Sugar (per oz)	Fats (per oz)	Protein (per oz)
Pasta	0.25	100	0.04	0.18	0.04
Nuts	0.75	200	0.05	0.36	0.14
Meat	0.50	110	0.00	0.11	0.25
Vegetable	0.20	25	0.03	0.02	0.04

Table 1.2: Nutrient content and cost of food.