# BANA4095 – Exam 3
# Spring 2020

You will have 120 minutes to complete this exam, and you may use your textbook, lecture notes, and other resources from the course to complete this exam. However, you may NOT access resources on the internet or communicate with anyone other than the instructor and teaching assistant during the exam. Read each question ***carefully*** and make sure that you answer each question ***completely***. You should download the template files from the Exam 3 link in Canvas and upload your files back in the Exam 3 link in Canvas when you are finished.

1. (60) Kloos Industries is considering undertaking several proposed projects for the next fiscal year. The cost and the expected profits for each project are summarized in the following table:

| | Project | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Cost ($1,000s) | 100 | 200 | 150 | 75 | 300 |
| Profit ($1,000,000s) | 1.0 | 1.8 | 2.0 | 1.5 | 3.6 |

   a. (45) Construct an optimization model using Python in a Jupyter Notebook and use it to find an optimal solution which maximizes the total profit of Kloos Industries subject to following constraints:

      *i.* Choose no fewer than three projects.
      *ii.* If project 3 is chosen, project 4 must be chosen.
      *iii.* If project 1 is chosen, project 5 must not be chosen.
      *iv.* The budget is 450.
      *v.* No more than two of projects 1, 2, and 3 can be chosen.

   b. (15) What is the second-best solution for this problem?

2. (40) RVW (Restored Volkswagens) buys 15 used VW's at each of three car auctions each week held at different locations. It then transports the cars to repair shops it contracts with. When they are restored to RVW's specifications, RVW sells 10 each to four different used car lots. There are transportation costs from each auction to each repair shop and from the repair shops to the used car lots. RVW is concerned with minimizing its total cost given the costs in the table below.

| | Repair Shops | |
|---|---|---|
| | S1 | S2 |
| Auction 1 | 550 | 500 |
| Auction 2 | 600 | 450 |
| Auction 3 | 525 | 525 |

| | Used Car Lots | | | |
|---|---|---|---|---|
| | L1 | L2 | L3 | L4 |
| S1 | 250 | 300 | 500 | 400 |
| S2 | 350 | 650 | 450 | 450 |

a. (25) Construct an optimization model using Python in a Jupyter Notebook and use it to find an optimal shipping schedule that will minimize total transportation costs for RVW.

b. (3) What is the value of additional purchase at the Auction 2?

c. (12) Describe how the optimal value changes as purchase at Auction 2 is increased up to 30 (Plot the results).