# MBA8580: Business Analytics: Assignment 3

This assignment is designed to introduce you to linear programming, integer programming and optimization modeling. Please read through all instructions for the assignment as they pertain to modeling issues with Solver.

## Instructions

1. Place all of the following problems in one Excel file on separate sheets (one sheet for each problem).

2. Submit only your team's final model for each problem.

3. Make sure that the solver dialogue box contains all the information for your model.

4. Make sure to answer all questions that are asked.

5. On the first sheet, put the names of all group members as well as all explanations for all of the problems.

6. Name the file with at least one group member's name in the filename.

7. Please do not zip your files.

See course schedule for due dates.

## Problem 1

After completing this course, you enroll in the data mining elective course which has one exam, a project, individual assignments, and class participation. Your scores on these grade components are shown below.

| Scores | |
|---|---|
| **Component** | **Score** |
| **Exam** | 75 |
| **Project** | 80 |
| **Assignments** | 88 |
| **Participation** | 96 |

The instructor has allowed you to determine your own weights for each of the four grade components with the following restrictions:

- The participation score can be weighted no more than 15% of the total

- Exam must count at least twice as much as the individual assignment score
- Project must count no more than three times the individual assignment score
- Project weight cannot exceed the exam weight
- Each of the four components must count for at least 10% of the course grade
- The weights must sum to 1.0 and be nonnegative

Use Solver to determine a valid set of weights to maximize your grade for the course.

## Problem 2

During the next six weeks, a company faces the following demands:

| Company Data | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Week** | 1 | 2 | 3 | 4 | 5 | 6 |
| **Demand** | 600 | 700 | 1000 | 1000 | 800 | 900 |

Unit production costs in weeks 1-6 are: $50, $50, $50, $60, $60, and $60 respectively. The storage cost from one week to the next is $25 per unit (assessed on ending inventory). At the beginning of week 1 the company has 500 units on hand. Unfortunately, its production process is such that there is a 20% yield (i.e., only 20% of the units it produces in any week are of sufficient quality to be used to meet demand). The remainder is discarded. All demand must be met each week.

    a. Determine how to minimize the cost of meeting demand over the next six weeks.
    b. Use SolverTable to determine how the optimal production quantities over the next six weeks vary as the production yield increases from 20% to 90% (in 10% unit increments).

## Problem 3

The software support division of GE has ten projects that can be performed. Each project requires different amounts of development time and testing time. In the coming planning period 700 hours of development time and 600 hours of testing time are available and no more than five projects can be selected. The company has allocated up to $25,000 to the projects. Due to some common resources the company cannot work on both projects 5 and 7 together in the planning period. Also, if GE chooses to take on project 6 it must also undertake project 10 and vice versa. Finally, GE can work on no more than two of the first five projects listed (i.e., no more than two projects can be chosen among projects 1, 2, 3, 4, and 5). The projected revenue and time required for each project are shown below. The table also indicates the fixed cost associated with undertaking each of the projects. Which projects should be selected to maximize profit?

| GE Data |
| --- |

| Project | Development Time (hr) | Testing Time (hr) | Revenue | Fixed Cost |
|---|---|---|---|---|
| 1 | 80 | 67 | $23,000 | $5,000 |
| 2 | 295 | 208 | $64,000 | $7,000 |
| 3 | 32 | 19 | $12,000 | $1,500 |
| 4 | 26 | 92 | $32,000 | $6,000 |
| 5 | 240 | 202 | $71,000 | $8,000 |
| 6 | 195 | 164 | $57,000 | $7,500 |
| 7 | 205 | 226 | $69,000 | $8,000 |
| 8 | 110 | 92 | $32,000 | $2,000 |
| 9 | 129 | 44 | $31,000 | $3,000 |
| 10 | 97 | 52 | $18,000 | $2,000 |

## Problem 4

Harry & David's Co. buys oranges and processes them into gift fruit baskets and fresh juice. The company grades the fruit it buys on a scale from 1 (lowest quality) to 5 (highest quality). The following table summarizes the company's current inventory level of fruit.

| Fruit | | | | | |
|---|---|---|---|---|---|
| Grade | 1 | 2 | 3 | 4 | 5 |
| Supply (1000's of lbs) | 172 | 288 | 415 | 333 | 92 |

Each pound of oranges devoted to fruit baskets results in a marginal profit of $2.50, whereas each pound devoted to fresh juice results in a marginal profit of $1.75. The company wants the fruit in its baskets to have an average quality grade of at least 3.75 and its fresh juice to have an average quality grade of at least 2.50.

Use Solver to determine **how many oranges of each grade should be used in fruit baskets and fresh juice** to maximize Harry & David's profit.