QuantModelling: Final Assignment

Title - Final Assignment
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● What factors affect the success of groups? Define three factors, e.g., GPA, gender, etc., that you feel affect the contributions that students make towards project success.

Some of the factors I am considering here are:

GPA

Interaction/involvement in class

Previous assignment performance

● How do the above factors combine to define success? For example, is a person with high GPA the same as one with a more relevant background? Decide on how each of the factors contribute toward your definition of success.

A person with a high GPA will continue to work hard to maintain their GPA and improve the group's performance.

A person who interacts more in the class likely tends to clear all doubts and performs better.

If an individual has been successfully submitting assignments and performing well in them, he/she will continue to do so.

● How will you collect data for these factors? For this assignment, randomly generate sensible data for each of the above three defined factors.

GPA can be easily collected from the student's grades.

Involvement in class can be measured through group discussions and activeness in class.

Previous Assignment Performance can be analyzed from grades in previous assignments.

	GPA	Interaction	Prevscore
Student1	4	5	4
Student2	2	4	3
Student3	2	3	4

Student4	5	4	2
Student5	3	4	4
Student6	4	4	4
Student7	5	5	5
Student8	3	4	5
Student9	5	5	3
Student10	4	5	4
Student11	3	3	2
Student12	1	1	1

Our constraints and objective function are based on the following 2 points:

1. Each group should have exactly 3 students

2. The objective is to maximize the chance of success for each group on a class project

● What are your decision variables?

X11 - Student 1 Group 1

X12 - Student 1 Group 2

X13 - Student 1 Group 3

X14 - Student 1 Group 4

X21 - Student 2 Group 1

X22 - Student 2 Group 2

X23 - Student 2 Group 3

X24 - Student 2 Group 4

X31 - Student 3 Group 1

X32 - Student 3 Group 2

X33 - Student 3 Group 3

X34 - Student 3 Group 4

X41 - Student 4 Group 1

X42 - Student 4 Group 2

X43 - Student 4 Group 3

X44 - Student 4 Group 4

X51 - Student 5 Group 1

X52 - Student 5 Group 2

X53 - Student 5 Group 3

X54 - Student 5 Group 4

and so on..

● What is your objective function?

max: +4X11 +4X12 +4X13 +4X14 +2X21 +2X22 +2X23 +2X24 +2X31 +2X32 +2X33 +2X34 +5X41 +5X42 +5X43 +5X44 +3X51 +3X52 +3X53 +3X54 +4X61 +4X62 +4X63 +4X64 +5X71 +5X72 +5X73 +5X74 +3X81 +3X82 +3X83 +3X84 +5X91 +5X92 +5X93 +5X94 +4X101 +4X102 +4X103 +4X104 +3X111 +3X112 +3X113 +3X114 +X121 +X122 +X123 +X124;

Considering only the GPA as the maximising factor.

● What are your constraints?

ST

Group1: +X11 +X21 + X31+ X41+ X51+ X61+ X71+ X81+ X91+ X101+ X111+ X121 = 3;
Group2: +X12 +X22 +X32 +X42 +X52 +X62 +X72 +X82 +X92 +X102 +X112 +X122 = 3;
Group3: +X13 +X23 +X33 +X43 +X53 +X63 +X73 +X83 +X93 +X103 +X113 +X123 = 3;
Group4: +X14 +X24 +X34 +X44 +X54 +X64 +X74 +X84 +X94 +X104 +X114 +X124 = 3;

Stu1: +X11 +X12 +X13 +X14 =1;

Stu2: +X21 +X22 +X23 +X24 =1;

Stu3: +X31 +X32 +X33 +X34 =1;

Stu4: +X41 +X42 +X43 +X44 =1;

Stu5: +X51 +X52 +X53 +X54 =1;

Stu6: +X61 +X62 +X63 +X64 =1;

Stu7: +X71 +X72 +X73 +X74 =1;

Stu8: +X81 +X82 +X83 +X84 =1;

Stu9: +X91 +X92 +X93 +X94 =1;

Stu10: +X101 +X102 +X103 +X104 =1;

Stu11: +X111 +X112 +X113 +X114 =1;

Stu12: +X121 +X122 +X123 +X124 =1;

GPAGroup1: +4X11 +2X21 + 2X31+ 5X41+ 3X51+ 4X61+ 5X71+ 3X81+ 5X91+ 4X101+ 3X111+ 1X121 >= 6;

GPAGroup2: +4X12 +2X22 + 2X32+ 5X42+ 3X52+ 4X62+ 5X72+ 3X82+ 5X92+ 4X102+ 3X112+ 1X122 >= 6;

GPAGroup3: +4X13 +2X23 + 2X33+ 5X43+ 3X53+ 4X63+ 5X73+ 3X83+ 5X93+ 4X103+ 3X113+ 1X123 >= 6;

GPAGroup4: +4X14 +2X24 + 2X34+ 5X44+ 3X54+ 4X64+ 5X74+ 3X84+ 5X94+ 4X104+ 3X114+ 1X124 >= 6;

InteractionGroup1: +5X11 +4X21 + 3X31+ 4X41+ 4X51+ 4X61+ 5X71+ 4X81+ 5X91+ 5X101+ 3X111+ 1X121 >= 8;

InteractionGroup2: +5X12 +4X22 + 3X32+ 4X42+ 4X52+ 4X62+ 5X72+ 4X82+ 5X92+ 5X102+ 3X112+ 1X122 >= 8;

InteractionGroup3: +5X13 +4X23 + 3X33+ 4X43+ 4X53+ 4X63+ 5X73+ 4X83+ 5X93+ 5X103+ 3X113+ 1X123 >= 8;

InteractionGroup4: +5X14 +4X24 + 3X34+ 4X44+ 4X54+ 4X64+ 5X74+ 4X84+ 5X94+ 5X104+ 3X114+ 1X124 >= 8;

PrevscoresGroup1: +4X11 +3X21 + 4X31+ 2X41+ 4X51+ 4X61+ 5X71+ 5X81+ 3X91+ 4X101+ 2X111+ 1X121 >= 8;

PrevscoresGroup2: +4X12 +3X22 + 4X32+ 2X42+ 4X52+ 4X62+ 5X72+ 5X82+ 3X92+ 4X102+ 2X112+ 1X122 >= 8;

PrevscoresGroup3: +4X13 +3X23 + 4X33+ 2X43+ 4X53+ 4X63+ 5X73+ 5X83+ 3X93+ 4X103+ 2X113+ 1X123 >= 8;

PrevscoresGroup4: +4X14 +3X24 + 4X34+ 2X44+ 4X54+ 4X64+ 5X74+ 5X84+ 3X94+ 4X104+ 2X114+ 1X124 >= 8;

#Let's run the lp and see how the students are assigned their groups.

```r
library(lpSolve)
library(lpSolveAPI)
y <- read.lp("F.lp")
y
```

```
Model name:
  a linear program with 48 decision variables and 28 constraints
```

Solving the problem to get objective function.

```
solve(y)
```

```
## [1] 0
```

```
get.objective(y)
```

```
## [1] 41
```

#Our Objective function is: 41.

#Let's look at the variables to understand what this means.

```
get.variables(y)
```

```
##  [1] 1 0 0 0 0 0 1 0 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 0 1 0 0 0 1 1 0 0
## [39] 0 0 0 0 1 0 0 0 0 1
```

What this shows is:

Students in Group 1: Student 1, Student 9 and Student 10.

Students in Group 2: Student 4, Student 5 and Student 6.

Students in Group 3: Student 2, Student 3 and Student 11.

Students in Group 4: Student 7, Student 8 and Student 12.

We can see that each student is assigned to exactly one group. Three students are assigned to each group. The assignment is related to the constraints based on the three factors we assigned for success for each of the groups, so all these groups have the maximised chance of success.