You're Hired!

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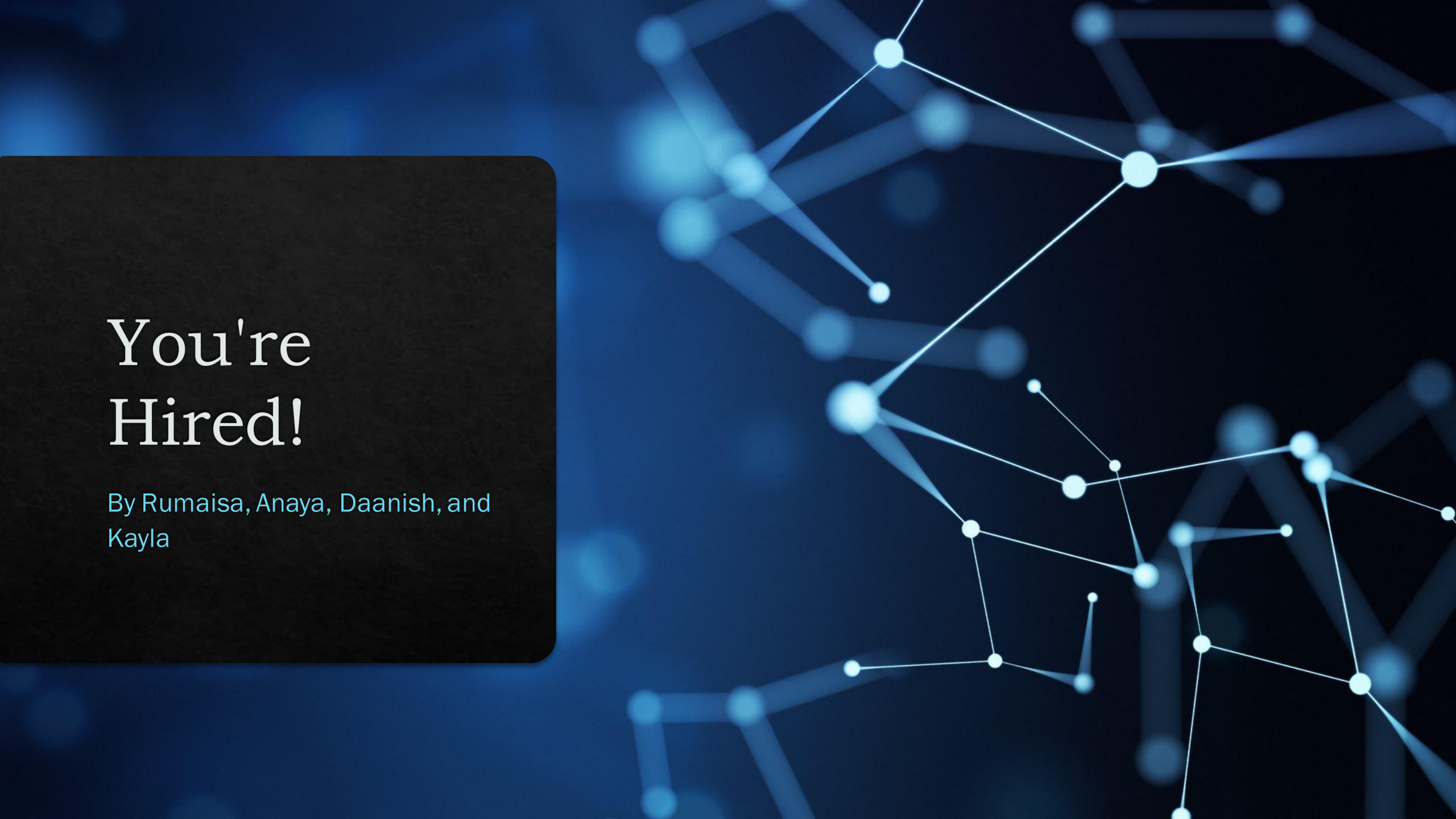

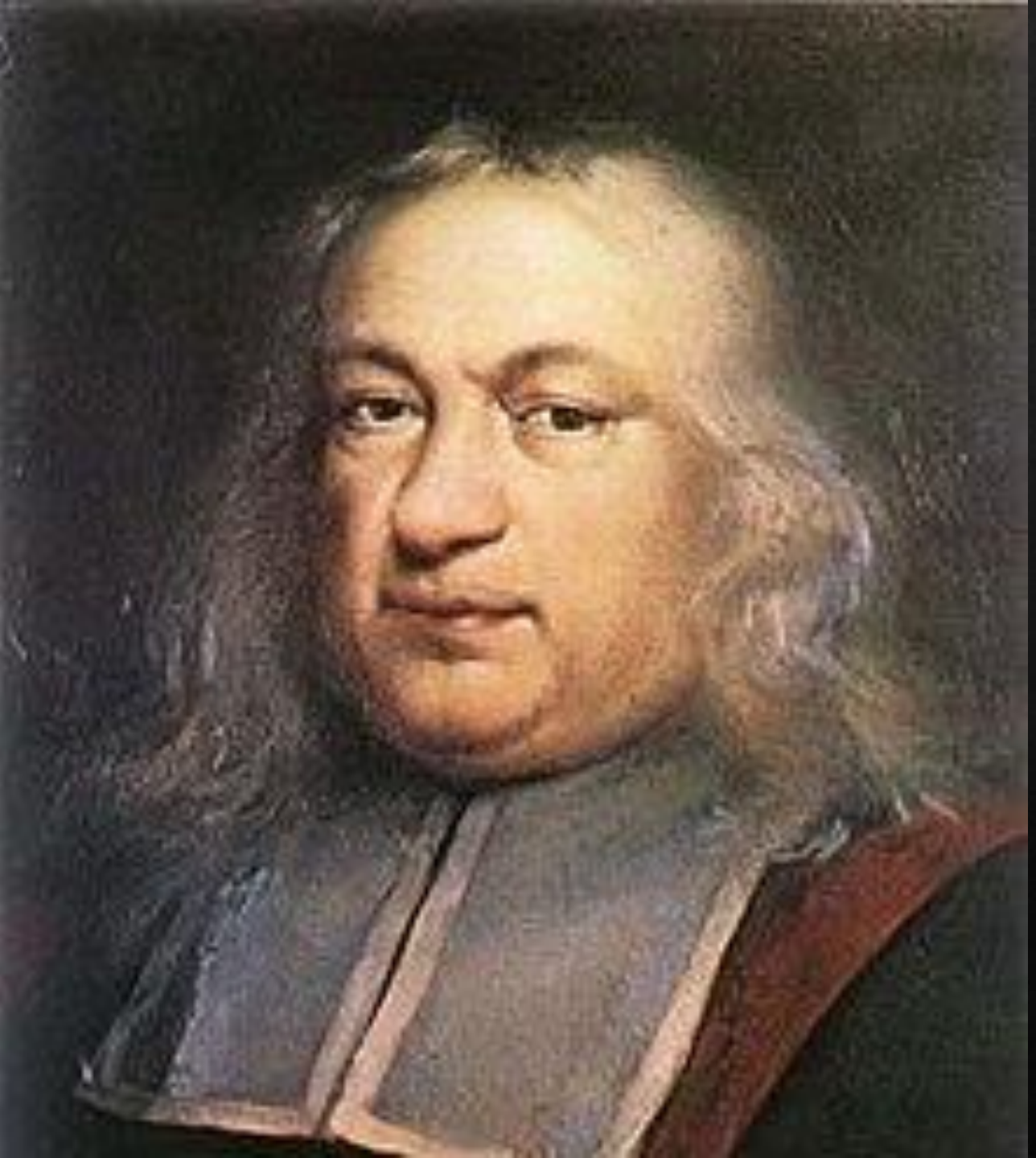

Problem

- Fermat School of Mathematics & Science is planning to increase the size of their school from 490 to 630 for the 2020-21 school year.
- To accommodate this increase, 7 additional faculty will be hired. There is a great deal of discussion on campus about which departments should get the extra teachers.
- Question: Should every major discipline each receive one new teacher, or should some departments should receive two new teachers while others receive none based on demand?

Given Information

- Student population for the 2019-20 school year was 490
- School is accepting 140 more students to the incoming sophomore class
- It is possible to hire a foreign language instructor who can teach 2 different languages
- Other faculty teach only in their discipline
- Current faculty:
  - 6 mathematics, 3 chemistry, 3 physics, 4 biology, 5 social studies
  - 5 English, 3 foreign language, 1 music instructor, 1 art instructor

Original Data

This is the original table provided to us from the problem. For each grade of FAMS, it shows the number of students enrolled in each subject listed under "Department"

Departmental Enrollment Totals: September 2019

Department	10th	11th	12th	Total
Art	31	33	35	99
Biology	198	95	26	319
Chemistry	59	126	109	294
English	183	155	152	490
French	41	32	49	122
German	19	22	10	51
Spanish	51	26	33	110
Mathematics	184	201	262	647
Music	50	56	49	155
Physics	50	58	183	291
Social Studies	183	131	59	373

Assumptions

- There are a maximum of 20 students per class
- English is a required subject for every year of FAMS
  - The number of students per grade in English is the total number of students in the grade
- Dropout rate from 10th to 11th grade takes in account 80% of the total dropouts in high school, and the remaining 20% drop out from 11th to 12th grade
  - The junior and senior class have roughly the same number of students while the sophomore class has a lot more students than the other classes
  - This is most likely due to the fact more students drop out after their 10th grade year
- The academic classes are divided up based on graduating class, more or less
- The new sophomore class will have 292 students, while the graduating seniors have 152 students
  - The incoming sophomores have 140 more students than the graduating class
- The proportions of students per class stays the same every year
- The three teachers for foreign language divide up so one teacher teaches each language

Original Data (modified)

This table (shortened from original) shows the number of faculty teaching each subject and the total number of students enrolled in a class of a subject.

Subject	Faculty	Students Enrolled
Math	6	647
Chemistry	3	294
Physics	3	291
Biology	4	319
Social Studies	5	373
English	5	490
French	1	122
German	1	51
Spanish	1	110
Music	1	155
Art	1	99

Figure 1

Step 1

Our first step was to find the student to teacher ratio. We divided the students enrolled by the number of faculty for each subject in Figure 1

Subject	Faculty	Students Enrolled
Math	6	647
Chemistry	3	294
Physics	3	291
Biology	4	319
Social Studies	5	373
English	5	490
French	1	122
German	1	51
Spanish	1	110
Music	1	155
Art	1	99

Figure 1

Subject	Student to Teacher Ratio
Math	107.833
Chemistry	98.
Physics	97.
Biology	79.75
Social Studies	74.6
English	98.
French	122.
German	51.
Spanish	110.
Music	155.
Art	99.

Figure 2

Step 2

Using the original data, we produced a smaller table showing the sophomore enrollment for the 2019-20 school year.

Subject	Last Year Sophomore Enrollment
Math	184
Chemistry	59
Physics	50
Biology	198
Social Studies	183
English	183
French	41
German	19
Spanish	51
Music	50
Art	31

Step 3

- We then used the fact that the new sophomore class was going to have 292 people
  - This means this class increased roughly 160% compared to last year's sophomores (183 people)
- We multiplied 1.6 by the previous sophomores' enrollment

Subject	Predicted Sophomore Enrollment
Math	294
Chemistry	94
Physics	80
Biology	316
Social Studies	292
English	292
French	65
German	30
Spanish	81
Music	80
Art	49

Step 4

We then subtracted the new sophomore enrollment by the old one to get a predicted increase

Subject	Predicted Increase in Sophomores
Math	110
Chemistry	35
Physics	30
Biology	118
Social Studies	109
English	109
French	24
German	11
Spanish	30
Music	30
Art	18

Step 5

We added the predicted increase in sophomores to last year's total enrollment

This gave us this year's predicted new enrollment for each subject

Subject	Current Faculty	New Total Enrollment
Math	6	757
Chemistry	3	329
Physics	3	321
Biology	4	437
Social Studies	5	482
English	5	599
French	1	146
German	1	62
Spanish	1	140
Music	1	185
Art	1	117

Step 6

- We used the new totals for each subject to calculate the student to teacher ratio if no new faculty were hired
  - We divided the students enrolled in each subject by the amount of faculty for each subject

Subject	Predicted Student to Teacher Ratio
Math	126.167
Chemistry	109.667
Physics	107.
Biology	109.25
Social Studies	96.4
English	119.8
French	146.
German	62.
Spanish	140.
Music	185.
Art	117.

Results

- We got our results by adding 1 more faculty on to subjects with the highest predicted student to teacher ratio
  - The goal was to reduce the ratio as close to 100 as possible
  - This resulted in the hiring of 7 more faculty
- We hired: 2 Math Teachers, 1 Chemistry Teacher, 1 Biology Teacher, 1 English Teacher, 1 Foreign Language Teacher (Can speak Spanish and French), and 1 Music Teacher

Subject	New Faculty	New Student to Teacher Ratio
Math	8	94.625
Chemistry	4	82.25
Physics	3	107.
Biology	5	87.4
Social Studies	5	96.4
English	6	99.8333
French	2	73.
German	1	62.
Spanish	2	70.
Music	2	92.5
Art	1	117.