Lab G5. Student Career

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I. Introduction

The purpose of this simulation is to assess the time to graduation and final grades for the Master of Science program. For the different graduation courses, I simulated a list of students with grades for all courses.

II. The Simulation Model

A. Stochastic Elements

In order to simulate students' career in the university. During the simulation, I applied some stochastic data to replace the data that cannot be obtained from the open source data. There are some stochastic elements in the proposed simulation model.

The List of Courses. For every master's student, a series of exams must be passed and a thesis completed before graduation. I use the list of course titles to describe the exams that students must pass. Here is A,B,C,D,E,F,G,H,I,J,K,L. The every letter represent a course name.

The Max Attend Times. In practice, a student can only take the same examination a maximum of four times. This is a mandatory examination limit.

The Probability of Pass Exams. A student's pass ratio per course is key to evaluating a student's career. As the number of courses a student takes per semester increases, their pass rate decreases. This is because students do not have enough time and energy to prepare for all the exams. Of course, the pass probability should be Bayesian distributed. Here is a Bayesian distribution table. I conclute the probability of event = 'the pass probability of course for a student, with the number of exams they attended.' For example, a student have attended 3 different courses, the pass probability of next course is that:

$$P_{BCD}(J) = (P_{BCD}(J) * P(J))/P_{BCD}$$

B. Input Parameters

There are three types of data I can access from open source datasets.

Grades Distribution. I obtained the grade distribution for each course from the POliTo website. There are 12 courses in total, which includes the grade distribution and the number of students with that grade. Fig 1 shows the distribution of grades across all courses.

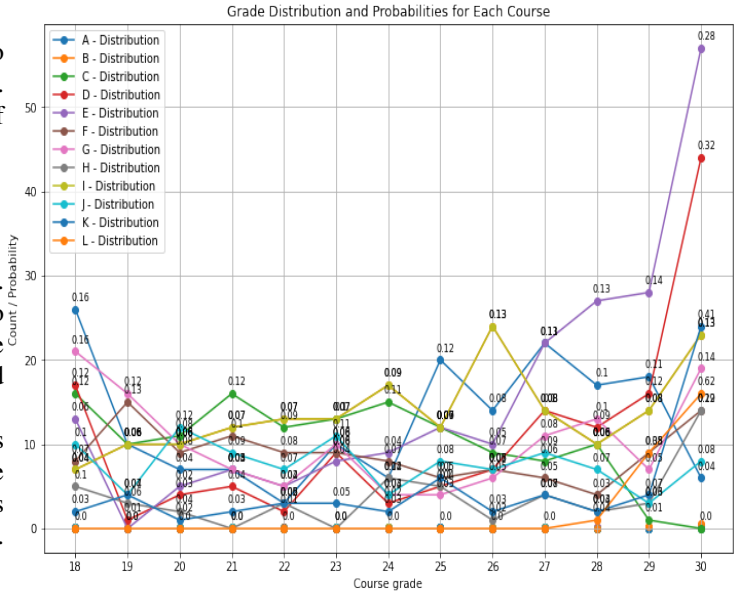

Fig. 1. All Courses Grades distribution

TABLE I
Pass Probability of the Number of Course

	Pass Probability			
Number of course	***Course = 1***	***Course = 2***	***Course = 3***	***Course = 4***
Probability	0.65	0.62	0.60	0.57
Number of course	Course = 5	Course = 6	Course = 7	Course = 8
probability	0.55	0.53	0.50	0.47
Number of course	Course = 9	Course = 10	Course = 11	Course = 12
probability	0.4	0.35	0.3	0.25

Accept Policy.I set up rules for each student to accept grades and let them decide whether or not to accept the final grade. If they pass the course, they have the right to decide whether or not to accept the grade. The rule states that if the grade is over 25 or if they take the exam more than 3 times, they will keep the grade. Otherwise, they will use randomized Bernoulli data to help them decide.

The Counter of attend exams. In the simulation, I have to keep track of the number of times a student takes each

exam in a particular course. It starts at 0 and goes to 4, but resets to 0 for the next school year.

C. Output

The list of Students. Each student is a student class object that records all the information, and they are collected in in the student list. The average graduation grade is calculated by adding all grades and dividing by the number of students. The average time to graduation is calculated by adding all times and dividing by the number of students.

The list of attended courses. Once a student passes a course, the passed course will be recorded in the list of courses taken. The average number of exams taken can be calculated by adding up all the exams taken and dividing by the number of courses.

Graduation Time. In the simulation, I set the initial number of cycles = 0. If a student takes the same exam more than 4 times, they can only take the next cycle of that course. Add 1 to the number of cycles and 1 to the graduation time until the student completes all courses.

The list courses. A course is also a class object that includes information such as the student's grades and the number of exams taken.

D. Output Metrics

The Average number of exams taken of Students. The average number of exams taken indicates the number of exams taken by each student.

The Average Graduation Time of Students. Average time to graduation indicates the average time to graduation for each student.

The Average Graduation Grades of Students. Graduation grade point average indicates the average graduation grade for each student.

As shown in Figure 4, I modeled the academic careers of 500 students. It shows trends in the number of exams taken, time to graduation, and grades.

III. Results

The Interesting Relationship. As shown in Figure 2, the average number of exams taken by the 20 students varied. This displays that most of the students took the course exams more than 2 times but less than 6 times. The mean is 3.96225 and the variance is 0.99.

The Final Results. As shown in Table 2, the mean time to graduation for the 500 students was 3.224 with a standard deviation of 0.73.The mean graduation score for the 500 students was 93.948.The mean number of times all the students took the exams was 5.86.The average number of times all the students took the exams was 5.86. In particular, the accuracy of all the results is almost close to 1.

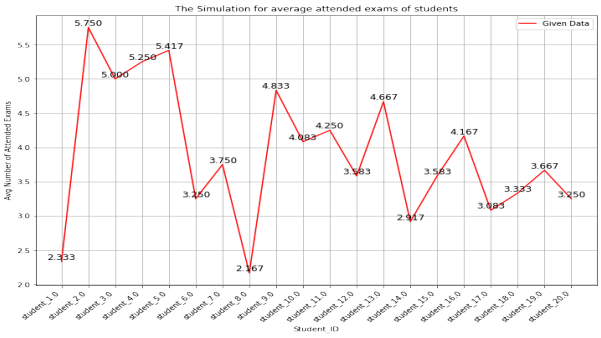

Fig. 2. Attended exams distribution

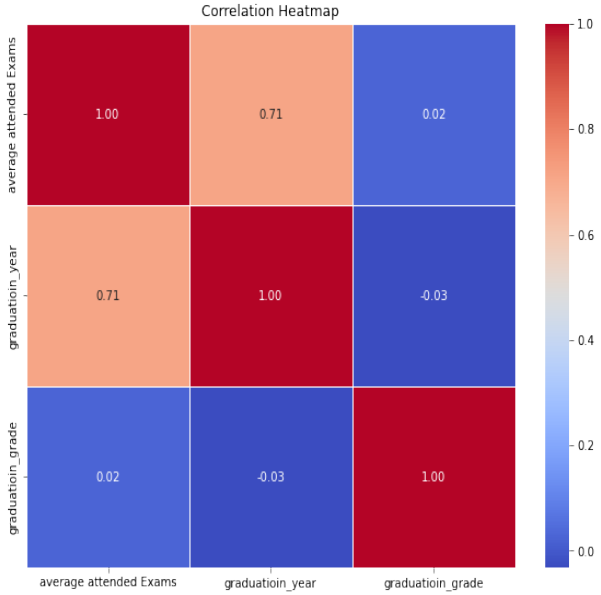

Fig. 3. Graduation grades and year

IV. Conclusion

It is very clear from Figure 3 that the final year of graduation is strongly correlated with the average number of exams, with a correlation rate of 0.7. This is consistent with reality. On the contrary, the final graduation grade is almost independent of the other parameters. The results show that the number of exams taken and the time to graduation have almost no effect on the final graduation grade, but if too many exams are taken, it will lead to a shorter time to graduation.

TABLE II
MEAN AND VARIANCE FOR STUDENTS WITH DIFFERENT GRADUATION CONDITIONS

Table	**The graduation simulation for students**		
	average attended Exams	***graduation year***	***graduation grade***
Mean	5.861200	3.224000	93.948070
Variance	3.694403	0.731287	19.845130
Accuracy	0.944751	0.980118	0.981485

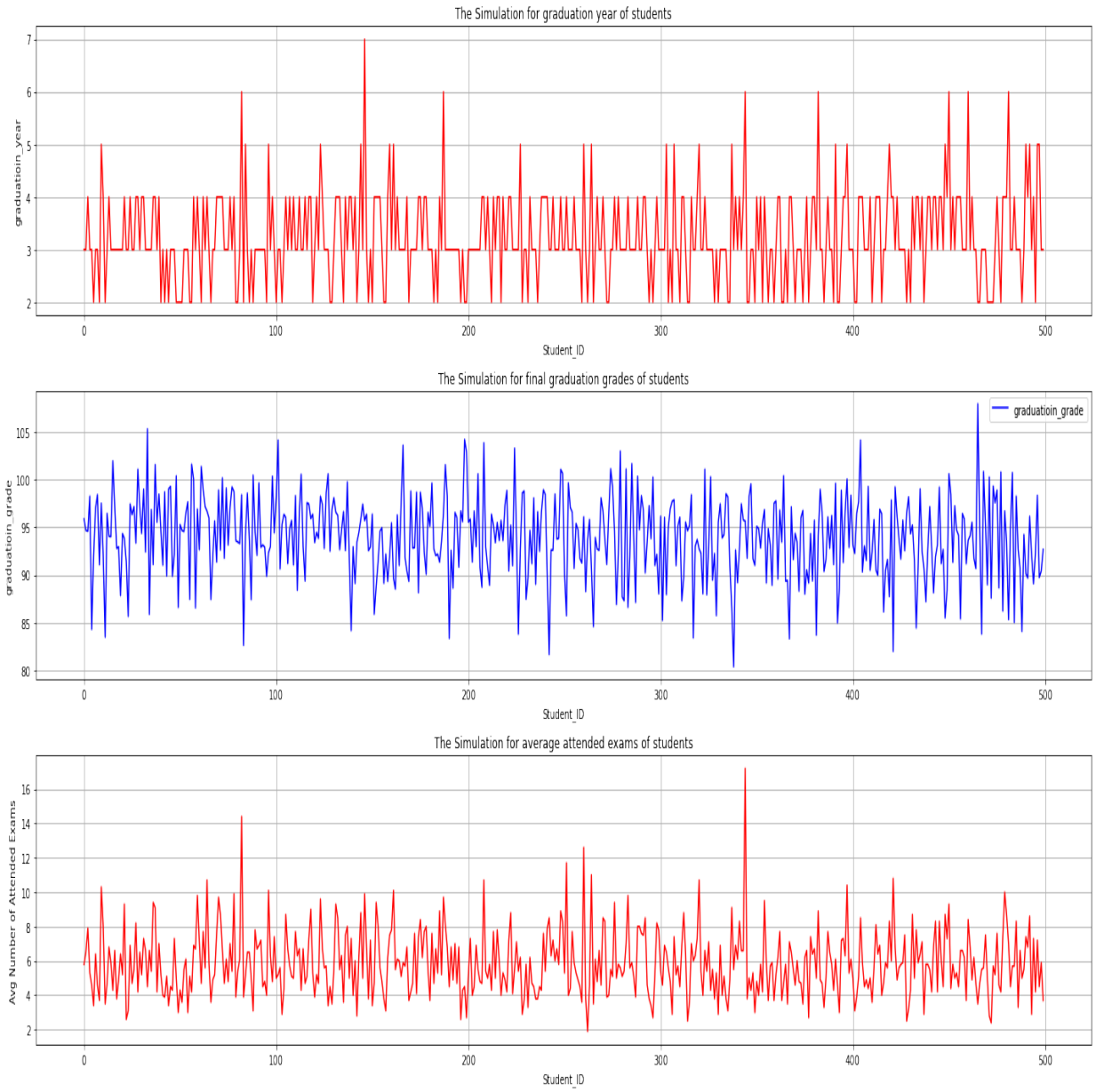

Fig. 4. The average of Graduation Grades, Graduation Year and Attend Number of Exams