Notation

- T represents the max quality of all universities in the uniform distribution from which random samples are drawn.
- W represents the max synergy between all universities in the uniform distribution from which random samples are drawn.
- Assume that the quality of university u is represented as Qu.
- Assume the synergy of student s with university u is Ss,u.
- Assume the aptitude of student s is As.

Part A

Question: What should a good strategy do when T = 0? Why?

- Answer: A good strategy to optimize payoff should focus on emphasizing synergy when T = 0. Setting T to zero nullifies the effects of qualities in the student's preferences. Succinctly, all universities are objectively equal in terms of quality. Given that student s forms preferences in decreasing order of Qu + Ss,u, we would basically only be considering Ss,u since Qu is 0 for all universities. Since each student only knows it's own aptitude which is fixed, and the university ranks based on As + Ss,u, we can only affect our chances by manipulating Ss,u so that we choose the schools whose synergies are higher.

Part B

Question: What should a good strategy do when W = 0? Why?

- Answer: A good strategy should focus on optimizing on university quality. Synergies are not taken into account when a student provide their preferences, we have to rely solely on the qualities of the schools. Thus, we sort our preferences in decreasing order of university quality because Qu + Ss,u becomes Qu.

Part C

Question: Provide a brief justification for your strategy. Focus on convincing the grader that it is a good strategy, by explaining the main ideas and why you chose this strategy.

Two conflicting objectives

- We want to maximize the score of the schools to which we want to be admitted, but at the same time, we want to avoid the case of not being matched at all. These are two conflicting objectives where middle-ground solutions have to be found.
- We had to change our code to be able to project some statistics like when we don't get a match (what's our aptitude then?) and total number of failure to match in one round using one strategy.

Normalizing our quantities

- We begin by forming our preferences by normalizing the schools' quality by their max quality T. We do the same for synergies. We, then, add the two normalized quantities for each school and then sort the array of schools.
- We also normalize our aptitude based on the maximum of the aptitudes.

Irrational players strategy

For the given dataset, we worked on some toy strategies and achieved good scores. We provide them here as proof of work.

- T = 0, choose schools based on their synergies. Achieved 0.92 scores in the dataset.
- W = 0, sort schools based on their qualities and choose schools [10 to 20). We couldn't choose the first 10 because some of the agents were consistently betting on the first 10 without considering their aptitude. Achieved 0.78 scores.
- W and T != 0, choose the first 7 schools: [1, 7) and choose safe schools from 15 to 18 or from 25 to 28 based on normalized aptitude. Achieved near 0.8 scores.

Rational players strategy

The difference between rational players and irrational agents is that rational players maximize their payoff. If they have a certain aptitude they will act upon it and they will get the school they deserve, unlike the irrational agents that we're provided initially.

- We split our schools into two buckets: preferred schools and safe schools. m is the number of preferred schools and 10 - m is the number of safe schools.
- Preferred schools are the ones that our normalized aptitude says we should end up in.
- Safe schools are ones that are randomly selected from [index of first preferred school + m, N]. We use random selection because we believe that other agents, rational as they are, will produce noisy (and sometimes irrational) preferences.
- The index of the first preferred school is (as mentioned in the bullet point above) decided based on the aptitude - some number to be a little optimistic.

An example would be if a student has an aptitude 50 and the maximum of aptitudes is 100. Then, their normalized aptitude is 0.5. The index of the first preferred school is 0.5 * N - 10. Where N is the total number of schools and 10 is the optimism factor. Say, the number of preferred schools m is 7. Then he adds 7 sequential schools from 0.5 * N - 10 to 0.5 * N - 10 + 7. Then they choose 3 random schools (without replacement) from [0.5 * N - 3, N].

- We think the safe-schools strategy is a successful one because we don't find ourselves choosing all schools that are likely to be chosen and thereby reducing our ability for payoff entirely.
- This strategy incorporates all the values at our disposal (S, T, W, qualities, synergies, and aptitude). It, also, accounts for skewness.
- It is hard to predict what other students in the class may develop so it is in our best interest to have some sort of contingency by choosing less popular schools.