



# A Guide to Course Match at Columbia Business School

Course Match is an advanced algorithm that assigns classes based on your preferences. This guide explains how it works and how to get the results you want.

# How Course Match works

## An overview of the mechanism

With Course Match, you sign up for classes by selecting every class you want to take and then ranking them in order of preference.

The algorithm uses the rankings submitted by you and your classmates to determine the demand for every class. Using that information, it gives students as many of their highly ranked classes as it can, given seat availability.

The Course Match algorithm is a direct application of market design theory, a Nobel Prize-winning field of economics. If you are interested, the academic literature explains its underlying mechanism in greater detail.<sup>1</sup>

### **General guidelines**

- Rank your personal preferences
- Allow Course Match to manage timing and curricular conflicts
- Adjust your rankings until you are comfortable

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<sup>1</sup> <http://pubsonline.informs.org/doi/pdf/10.1287/opre.2016.1544>



# Step 1: Select the right number of classes

Give Course Match options to create an optimal schedule

Course Match assigns your schedule by trying to give you as many of your top ranked classes as it can.

If it cannot give you a top pick, Course Match will put together a combination of classes that gives you as many of your remaining top choices as possible.

Course Match needs options to do this, so it is vital that you select an appropriate number of classes. We advise selecting twice as many classes as you need.

## **Selection guidelines**

- Select any class that you might be interested in taking (even if it is not your top pick)
- Do not select a class that you would not want to take
- Select at least twice as many classes as you need



# Step 2: Rank your classes

Your best course of action is to rank your classes according to your honest preferences

You will drag-and-drop your selected classes into four buckets: Favorite, Great, Good, and Acceptable.

The order in which you rank your classes matters.

Think of the different buckets as separate floors of a building (use this for large distinctions) and the order within buckets as steps on a staircase (use this for small distinctions). Placing a course in a higher ranked bucket means you would want a schedule with that course more than a schedule containing 3-4 classes in the next bucket below.

You can place as many classes as you wish in any bucket, except for Favorite, which can have only one class. You can leave any bucket empty.

## **Ranking guidelines**

- Rank your classes according to your preferences (and not based on how you think other students will rank their selections)
- Use buckets for large distinctions in preference
- Use the order within buckets for small distinctions in preference



# Step 3: Review your rankings

Make sure you like the schedules that Course Match shows you

Course Match will show you the eight best schedules you could receive based on your rankings.

It automatically handles timing and curricular conflicts, so every schedule is valid.

However, it is critical that these schedules reflect what you *actually* want. If they do, you are done. If not, go back and adjust your selections and rankings.

If there is a greater demand than available seats for your top pick classes, you may receive a schedule not in your top eight.

## **Reviewing guidelines**

- Make sure you like all of the classes that you see
- Check that section times work for you
- Go back and adjust either your selections or rankings until you are satisfied



# Advanced functionality: Rules

A rule tells Course Match which classes you consider substitutes

In some cases, you may wish to enroll in only one of a group of classes, even if you have ranked them all highly.

Communicate this to Course Match using the Rules section on the bottom of the ranking page.

A rule allows you to say how many of a group of classes you would like to take – as few as one and as many as three.

Create rules on the ranking page by clicking the add rule button and selecting the classes it applies to:

## **Rules guidelines**

- Rank your classes as you normally would
- Decide which classes you want to treat as substitutes
- Create a rule by clicking on the add rule button



# Additional Helpful Details

## Useful Terminology

To understand better how Course Match works, the following terms are useful:

**Preferences:** As a student, you have a relative preference for each of the course sections offered each semester. Some course sections you may strongly prefer, others less so, and some you do not want to take at all. Course Match asks that you state your true, relative preferences for the course sections as you are interested to take, even if they are not highly preferred. You communicate your preferences by placing course sections into up to four categories (Favorite, Great, Good, and Acceptable) and ordering them within each category from most to least preferred.

**Utility:** Underlying your preferences is the amount of “utility” (a.k.a. “happiness” or “value”) that you would get from any particular schedule of courses. Course Match does not ask you directly for the utility of every possible schedule. Instead, Course Match takes your preferences over course sections from the rankings and uses them to estimate the utility of every possible schedule. It then tries to get students the schedule that maximizes utility and fits within their budget.

**Budgets:** Each student is assigned a budget. 1st year students have lower budgets than 2nd year students and, for spring 2022, 2nd year student budgets are based on the “bid points” that were left over after their second term. Course Match also creates small variations in budgets to break ties when students have the same preferences. Course Match uses your budget to purchase your best possible schedule, based on clearing prices.

**Clearing Prices:** Each course section has a clearing price determined by the supply of available seats and student demand. Clearing prices are established by the system only AFTER all students have reported their preferences; they are calculated by Course Match based on the aggregate preferences reported by the entire student population.



# Tips to improve your results

## Identifying Classes to Rank

Students should browse course offerings and identify all the courses in which they are interested. Because you may not get a seat in all of your most preferred classes, you should add significantly more credits than you need, something between 2x and 4x. Adding more can never decrease the chances of getting your most preferred sections, but it can help increase those chances. Why? Because those added classes may have low clearing prices, allowing you to afford the classes you highly prefer and still meet your target credits.

The Course Match platform currently forces students to add 2x the number of credits they are targeting to have in their final schedule. While it is possible to “hack” the 2x requirement by selecting multiple sections of the same course, all of which will count towards the total, this will put you at a disadvantage!!! Try to make sure that you have at least 2x your target credits with unique courses that don’t conflict with each other.

## Ranking Classes

There are four categories, or “buckets”: Favorite, Great, Good, and Acceptable. You can place only one class as your favorite, but an unlimited number of classes into the other buckets. How you place course sections into ranking categories, and the order you place them, indicate your preferences for each section relative to the others that YOU rank.

Why are there four categories rather than a single list of courses? The categories help you communicate to Course Match how your preferences for individual courses translate into preferences over schedules. It does this by assigning a quantitative “utility” to each course, depending on the distribution of courses across the four categories. Course Match interprets the change in utility to be very significant from one category to the next, but modest from one class section to the next within a category.

The utilities assigned to courses are relative to how YOU rank other courses and NOT relative to how OTHER students rank courses. For example, suppose that student A puts her top ranked course in the Favorite bucket while student B puts his top ranked course in the Great bucket (leaving Favorite empty). Course Match will assign these top ranked courses the same utility. In other words, the Course Match algorithm will not value student A’s utility as higher than student B just because it was placed in a higher category. However, A’s 2nd ranked (Great) course will be assigned much lower utility





than her top ranked (Favorite) course, while B's 2nd ranked (Great) course is assigned only modestly lower utility than his first ranked (Great) course, since both are Great.

Students should therefore use the categories to inform Course Match when there are large jumps in their preferences (utility) across courses. Let's use a theoretical example, with round numbers picked for illustrative purposes. If a student ranked four courses, one in each bucket (Favorite, Great, Good, and Acceptable), they might be assigned utility values of 10,000, 1,000, 100, and 10. If the student instead ranked all four courses in the same bucket, the assigned utilities might be 10,000, 9,500, 9,000, and 8,500.

Given the large change in utility between buckets, Course Match recommends ranking a course in the Favorite category only if you truly have a strong preference for that course over your 2nd most preferred. Make sure you really want a Favorite course far more than the subsequently ranked Great courses, because you may receive an assigned schedule that includes your Favorite but lacks any of the Greats. The same is true for thinking about the difference between rankings from Great to Good. If you put a course in the Great bucket, it indicates that you would prefer a schedule with that Great course to one with several of the Good courses.

### **Understanding the Course Match Allocation**

After you submit course rankings, the algorithm puts together a list of every possible valid schedule combination for each student and orders them by utility. Once all students' schedules are ordered by utility, the algorithm looks at supply and demand for each course, determines clearing prices, and gives each student the highest utility schedule that they can afford given their budget.

Note that the algorithm will always assign a schedule that meets students' minimum credit thresholds if at all possible. If the algorithm cannot assign a complete schedule, based on a student's selections and clearing prices, it will assign the best incomplete schedule available. This is why it is important for all students to provide a sufficiently extensive list of course preferences. Listing additional preferences does not decrease a student's chances of being assigned their top ranked courses, but it gives the algorithm a greater chance of allocating a complete schedule that includes these top ranked selections.



# Frequently asked questions

## **#1 – What is the biggest mistake I can make?**

Not ranking enough classes.

It can be tempting to list just the classes you want most. But if you do that, Course Match might not be able to give you a schedule you like.

The algorithm works to give you what you asked for, but it cannot be unfair to your classmates. When that is the case, it uses your remaining classes to work out an optimal combination.

If you rank too few classes, Course Match may be forced to sacrifice a class you value highly or fail to give you a full schedule.

In fact, when we analyzed the results of a recent allocation at a top business school, we found that students who ranked just the minimum number of sections were 2.1 times less likely to receive their Favorite section than the students who ranked more sections.

## **#2 – What is the second biggest mistake I can make?**

Ranking classes incorrectly.

Your rankings communicate to Course Match how you feel about classes and guide the trade-offs it must make. Be thoughtful about the classes you think of as substitutes and which you care about more deeply.

One way to understand rankings is to think of the differences between buckets as those between the floors of a building and the differences within buckets as between steps on a staircase.

Also, resist the temptation to rank classes highly just because you think they are popular. In figuring out trade-offs as it assembles your schedule, Course Match may skip classes you actually want to get you what you ranked higher.

Your best approach is to rank according to *your* preferences and to communicate your preferences honestly.

## **#3 – Why didn't I get my full allotment of courses?**

You did not list enough classes.

As mentioned above, Course Match uses your rankings to find a combination of classes that maximizes your utility while being fair to other students.



In this case, if you had been given all the classes you had ranked, it would have been unfair to your classmates.

And because you did not include other options, Course Match was forced to give you an incomplete schedule.

This can be easily avoided by following the rule of thumb that you should rank at least twice as many classes as you actually need.

#### **#4 – I didn't get my Favorite class but my friend who ranked it lower than me did. Why?**

Most probably because you could not afford it, but your friend could.

Course Match gives every student an initial budget, but then adds a random tie-breaker for each student (so no one is exactly the same).

In this case, your friend may have had a larger budget (or tie-breaker) and had chosen a Favorite class with lower demand, leaving the bulk of her purchasing power unused. Course Match was able to provide both her top pick class and this class.

On the other hand, you could not afford this class, so Course Match created a combination of classes based on your remaining rankings.

The other possible reason may be that you did not give Course Match enough options, so even though you could afford the class on its own, you could not have afforded a full schedule that included this class. If you included more courses for Course Match to consider, you may have received a schedule with your top choice because Course Match could make a complete schedule within your budget.

#### **#5 – My schedule doesn't look like what the system showed me during course selection. Why?**

Course Match can create many possible schedules combinations on the basis of your rankings. It shows you the top eight.

Sometimes getting one of those is not possible, particularly when overall demand for your top pick class is greater than the available seats. In that case, a tie-breaker determines who gets into the class.

If you do not get your top pick class, Course Match assembles the best possible schedule using your remaining rankings.

However, if that schedule was not one of your top eight, it will not have appeared during course selection.

