Appendix A. Matching algorithms

This section describes the deferred-acceptance and the top-trading-cycles algorithms with the help of the text used in the experimental instructions.[29]

Deferred acceptance (DA)[30]

- In this experiment, students in each group belong to a specific school district. Your "local school" and those of the computer players are going to be indicated on the computer screen.
  NOTE: In this simulation, each school has one slot, but it can happen that more than one student lives in the same district.

- In each group, every student submits a ranking of schools which is used in the following procedure to allocate school places.

- The priority order for each school is separately determined as follows:

  – High Priority Level: Participants who live within the school district.

  – Low Priority Level: Participants who do not live within the school district. The priority among the Low priority students is based on their respective order in a fair lottery. This means each participant has an equal chance of being the first in the line, the second in the line, ..., as well as the last in the line. The computer is going to determine the outcome of this fair lottery. You will be informed about the outcome of the lottery on the screen.

- Once the priorities are determined, the allocation of school slots is obtained as follows:

  – An application to the highest ranked school on the submitted ranking is sent for each participant.

  – Throughout the allocation process, a school can hold no more applications than its number of slots. If a school receives more applications than its capacity, then it rejects the students with lowest priority orders. The remaining applications are retained.

[29] Note that we closely follow the set of instructions used by Chen et al. (2016).

[30] The description of RDA is identical except that the expressions highest and next highest should be replaced by lowest and next lowest, respectively.

- Whenever an applicant is rejected at a school, his application is sent to the next highest school on his/her submitted ranking.
- Whenever a school receives new applications, these applications are considered together with the retained applications for that school. Among the retained and new applications, the lowest priority ones in excess of the number of the slots are rejected, while remaining applications are retained.
- The allocation is finalised when no more applications can be rejected. Each participant is assigned a slot at the school that holds his/her application at the end of the process.

Top trading cycles (TTC)[31]

- In this experiment, students in each group belong to a specific school district. Your "local school" and those of the computer players are going to be indicated on the computer screen.
  NOTE: In this simulation, each school has one slot, but it can happen that more than one student lives in the same district.
- In each group, every student submits a ranking of schools which is used in the following procedure to allocate school places.
- Each student is first tentatively assigned to the school within his/her respective district.

  Next, the submitted rankings are used to determine the school allocation through exchanges. The order in which these exchanges are considered is determined by a fair lottery. This means each student has an equal chance of being the first in the line, the second in the line, ..., as well as the last in the line. You are going to receive information about the outcome of the lottery on the screen.
- The specific allocation process is explained below.
  - Initially all slots are available for allocation.
  - All students are ordered in a queue based on the order in the lottery.

[31] The description of RTTC is identical except that the expressions highest and next highest should be replaced by lowest and next lowest, respectively.

- Next, an application to the highest ranked school in the submitted ranking is submitted for the student at the top of the queue.
    - If the application is submitted to his district school, then his tentative assignment is finalised (thus he is assigned a slot at his district school). The student and his assignment are removed from subsequent allocations. The process continues with the next student in line.
    - If the application is submitted to another school, say school B, and that school has a vacant slot (it has no other student tentatively assigned), then the requester is assigned to school B. The student and his assignment are removed from subsequent allocations. The process continues with the next student in line.
    - If the application is submitted to another school, say school C, and that school has no vacant slot (it has another student tentatively assigned), then the first student in the queue who tentatively holds a slot at School C is moved to the top of the queue directly in front of the requester.
- Whenever the queue is modified, the process continues similarly: An application is submitted to the highest ranked school with available slots for the student at the top of the queue.
    - If the application is submitted to his district school, then his tentative assignment is finalised. The process continues with the next student in line.
    - If the application is submitted to another school, say school B, and that school has a vacant slot (it has no other student tentatively assigned), then the requester is assigned to school B. The student and his assignment are removed from subsequent allocations. The process continues with the next student in line.
    - If the application is submitted to another school, say school C, and that school has no vacant slot (it has another student tentatively assigned), then the first student in the queue who tentatively holds a slot at school C is moved to the top of the queue directly in front of the requester. This way, each student is guaranteed an assignment based on the preferences indicated in the submitted ranking.
- An exchange is obtained when a cycle of applications are made in

sequence, e.g., I apply to John‘s district school, John applies to your district school, and you apply to my district school. In this case, the exchange is completed and the students as well as their assignments are removed from subsequent allocations.

– The process continues until all students are assigned a school slot.

Appendix B. Additional results

Appendix B.1. More on strategic sophistication

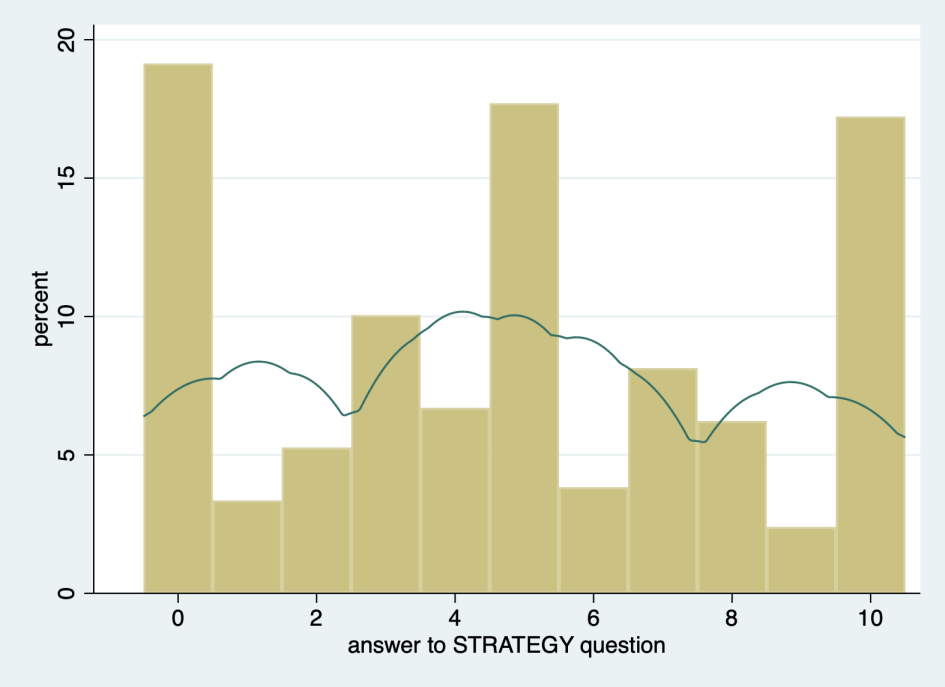


Figure B.1: Distribution of answers to the STRATEGY question. Frequency histogram and Epanechnikov kernel estimates. STRATEGY: Please indicate your degree of agreement to the following statement (0 - strongly disagree, 10 - strongly agree). "There was a best strategy for reporting preferences in the student allocation task."

Appendix B.2. More on the revelation principle

In the main text we argue that the revelation principle does not hold as a general equivalence result between strategy-proof and other mechanisms with an equilibrium in dominant strategies. As for a direct test, you will recall that, based on the usual assumption of decision-makers' rationality and sophistication, theory predicts that all four analysed matching mechanisms produce stable and efficient matchings as the final outcome (prediction 2). Our experimental results clearly reject this prediction (table B.5). The best-performing mechanism, DA, implemented stable and efficient matchings in about three quarters of the time, while

Table B.5: Proportion of student-stable/efficient matchings.

	Deferred Acceptance	Top Trading Cycles	Reverse Deferred Acceptance	Reverse Top Trading Cycles
	72.00%	53.57%	55.10%	48.15%
	p-values for pairwise two-sided comparisons			
Deferred Acceptance	-	0.05	0.08	0.01
Top Trading Cycles	-	-	0.88	0.57
Reverse Deferred Acceptance	-	-	-	0.48

the other three did so in about half of the time. Although comparisons based on statistical tests are not transitive in general, our data leads us conclude that, in terms of stability and efficiency, DA outperforms the other three mechanisms which are statistically identical. For the sake of precision, and because some might not consider a difference with a p-value of 0.08 statistically significant, we state these findings as follow.

Result 5. *Counter to prediction 2, the analysed mechanisms do not always induce stable and efficient matchings. In terms of stability and efficiency, the DA mechanism is not worse than the RDA, the TTC or the RTTC mechanisms which are undistinguishable from each other.*

It is worth noting that Chen and Sönmez (2006) find that the DA and TTC mechanisms perform equally well in terms of efficiency, and Calsamiglia et al. (2010) observe that DA produces stable matchings more often than TTC (in a school-allocation setting similar to ours in both studies). Although the conclusions based on comparisons among the numbers in table B.5 are similar to those in the existing literature, our experimental design is not able to deliver sharp estimates for the stability (and efficiency) of the market outcome. Note that our experimental design targets individual behaviour (i.e., strategy-proofness which is the main focus of our paper) instead of the aggregate outcome. It is built on a specific preference profile and only allows for untruthful behaviour for the human decision-maker. With these features, in our school-choice problem there exist only two possible market outcomes: $\{(R_1, C), (R_2, B), (R_3, D), (H, A)\}$ and $\{(R_1, C), (R_2, A), (R_3, D), (H, B)\}$.[32] Thus, by design, not only just one market

[32] Had our experimental design informed the human decision-maker about the entire preference profile, instead of keeping the robots' preferences hidden, our experimental subjects would have faced a situation in which multiple weakly dominant strategies exist. Essentially, all strategies (for the human decision-maker) that rank A above B in the direct mechanisms (and those that rank B above A in the reverse mechanisms) would be weakly dominant in such a game.

participant is allowed to strategise, but also the possible harm in terms of stability and efficiency caused by that strategising behaviour is bounded from above. Notwithstanding, the observed difference between the DA mechanism and its reverse version questions the empirical relevance of the revelation principle even if based on the observed outcomes we can not tell TTC and RTTC apart.

One could say that by definition (and design) strategy-proof direct mechanisms are robust to naïve behaviour. Just as the popular strategy-proof mechanisms benefit from naïve truth-telling, (matching) mechanisms in general can benefit from various behavioural biases. Our reverse mechanisms, for instance, deliver the theoretical equilibrium outcome when the decision-maker suffers from naïve district-school bias, that is when she reports the induced preference order truthfully except that she moves her district school (at which she enjoys priority) to the top of the ranking. Note that in our school-allocation problem, with robots playing the equilibrium strategy, for the final outcome it only mattered how the human decision-maker ranked schools A and B with respect to each other. This is why prediction 2, the revelation principle written in terms of payoffs, is harder to refute by observing experimental outcomes. We argue, however, that the revelation principle is a theoretical result that builds on (and can not hold without) rationality, that is our prediction 1.

Appendix C. Instructions

The following text was used to create the Japanese version of the experimental instructions for our treatments. Note that we closely follow the set of instructions used by Chen et al. (2016) in all of them. The Japanese versions used in the experiments are available upon request.

Appendix C.1. Instructions for DA

This is an experiment in the economics of decision making. The instructions are simple, and if you follow them carefully and make good decisions, you might earn a considerable amount of money (in addition to a ¥700 participation fee). In this experiment, we simulate a procedure to allocate students to schools. The procedure, payment rules, and student allocation method are described below. Do not communicate with each other during the experiment. If you have questions at any point during the experiment, raise your hand and the experimenter will help you.

Procedure

- Please the read these instructions first before proceeding to the computer program. You may consult the instructions at any time during the experiment.

- Each participant is randomly assigned to a group of 4 decision-makers. Each group includes 3 computers and a participant. This means that you are going to interact with 3 computers in this experiment. The computers will act to maximise their expected gain.

- In this simulation, each member of your group acts as a student who is looking for a slot at one of the schools. 4 school slots are available across 4 schools (A, B, C, D) in each group. There is one slot available at each school.

- You will receive a cash payment at the end of the experiment. Your payoff amount depends on the school slot you hold at the end of the experiment. Payoff amounts are going to be outlined on the computer screen.
  NOTE: Different participants and different computers may or may not have different payoff tables. That is, payoff by school may or may not be different for different participants and different computers.

- During the experiment, each participant first completes a quiz which consists of an allocation instance for you to solve. You will have up to 10 minutes to solve it, and will receive ¥100 if you submit the correct answer.
- After you have finished the quiz you may start the school allocation task. You will have up to 20 minutes to complete the school allocation task.
- After all participants have completed the school allocation task, the allocation process starts.
- Once the allocations are determined, each participant will be informed of his/her allocation slot and respective payoff. The school allocation will be performed based on the following school allocation method.

Allocation Method

- In this experiment, students in each group belong to a specific school districts. Your "local school" and those of the computer players are going to be indicated on the computer screen.
  NOTE: In this simulation, each school has one slot, but it can happen that more than one student lives in the same district.
- In each group, every student submits a ranking of schools which is used in the following procedure to allocate school places.
- The priority order for each school is separately determined as follows:
  - High Priority Level: Participants who live within the school district.
  - Low Priority Level: Participants who do not live within the school district. The priority among the Low priority students is based on their respective order in a fair lottery. This means each participant has an equal chance of being the first in the line, the second in the line, ..., as well as the last in the line. The computer is going to determine the outcome of this fair lottery. You will be informed about the outcome of the lottery on the screen.
- Once the priorities are determined, the allocation of school slots is obtained as follows:
  - An application to the highest ranked school on the submitted ranking is sent for each participant.

- Through out the allocation process, a school can hold no more applications than its number of slots. If a school receives more applications than its capacity, then it rejects the students with lowest priority orders. The remaining applications are retained.
- Whenever an applicant is rejected at a school, his application is sent to the next highest school on his/her submitted ranking.
- Whenever a school receives new applications, these applications are considered together with the retained applications for that school. Among the retained and new applications, the lowest priority ones in excess of the number of the slots are rejected, while remaining applications are retained.
- The allocation is finalised when no more applications can be rejected. Each participant is assigned a slot at the school that holds his/her application at the end of the process.

An Example

We go through a simple example to illustrate how the allocation method works.

Students and Schools: In this example, there are six students, 1-6, and four schools, Clair, Erie, Huron and Ontario.

Student ID Number: 1, 2, 3, 4, 5, 6	Schools: Clair, Erie, Huron, Ontario

Slots and Residents: There are two slots each at Clair and Erie, and one slot each at Huron and Ontario. Residents of districts are indicated in the table below.

School	Slot 1	Slot 2	District Residents
Clair	☐	☐	1 2
Erie	☐	☐	3 4
Huron	☐		5
Ontario	☐		6

Lottery: The lottery produces the following order.

1 - 2 - 3 - 4 - 5 - 6

Submitted School Rankings: The students submit the following school rankings:

	1st Choice	2nd Choice	3rd Choice	Last Choice
Student 1	Huron	Clair	Ontario	Erie
Student 2	Huron	Ontario	Clair	Erie
Student 3	Ontario	Clair	Erie	Huron
Student 4	Huron	Clair	Ontario	Erie
Student 5	Ontario	Huron	Clair	Erie
Student 6	Clair	Erie	Ontario	Huron

Lottery: School priorities first depend on whether the school is a district school, and next on the lottery order:

	Resident	Non-Resident
Priority order at Clair:	1 - 2	- 3 - 4 - 5 - 6
Priority order at Erie:	3 - 4	- 1 - 2 - 5 - 6
Priority order at Huron:	5	- 1 - 2 - 3 - 4 - 6
Priority order at Ontario:	6	- 1 - 2 - 3 - 4 - 5

This allocation method consists of the following steps:

Step 1: Each student applies to his/her first choice: students 1, 2 and 4 apply to Huron, students 3 and 5 apply to Ontario, and student 6 applies to Clair.

- Clair holds the application of student 6.
- Huron holds the application of student 1 and rejects students 2 and 4.
- Ontario holds the application of student 3 and rejects student 5.

Applicants		School		Hold	Reject
6	→	Clair	→	6	
	→	Erie	→		
1, 2, 4	→	Huron	→	1	2, 4
3, 5	→	Ontario	→	3	5

Step 2: Each student rejected in Step 1 applies to his/her next highest choice: student 2 applies to Ontario, student 4 applies to Clair, and student 5 applies to Huron.

- Clair considers the application of student 4 together with the application of student 6, which was on hold. It holds both applications.
- Huron considers the application of student 5 together with the application of student 1, which was on hold. It holds the application of student 5 and rejects student 1.
- Ontario considers the application of student 2 together with the application of student 3, which was on hold. It holds the application of student 2 and rejects student 3.

Hold	New applicants		School		Hold	Reject
6	4	→	Clair	→	6 4	
		→	Erie	→		
1	5	→	Huron	→	5	1
3	2	→	Ontario	→	2	3

Step 3: Each student rejected in Step 2 applies to his/her next highest choice: Students 1 and 3 apply to Clair.

- Clair considers the applications of students 1 and 3 together with the applications of students 4 and 6, which were on hold. It holds the applications of students 1 and 3 and rejects students 4 and 6.

Hold	New applicants		School		Hold	Reject
6 4	1, 3	→	Clair	→	1 3	4, 6
		→	Erie	→		
5		→	Huron	→	5	
2		→	Ontario	→	2	

Step 4: Each student rejected in Step 3 applies to his/her next highest choice: Student 4 applies to Ontario and student 6 applies to Erie.

- Ontario considers the application of student 4 together with the application of student 2, which was on hold. It holds the application of student 2 and rejects student 4.
- Erie holds the application of student 6.

Hold	New applicants		School		Hold	Reject
1 3		→	Clair	→	1 3	
	6	→	Erie	→	6	
5		→	Huron	→	5	
2	4	→	Ontario	→	2	4

Step 5: Each student rejected in Step 4 applies to his/her next highest choice: student 4 applies to Erie.

- Erie considers the application of student 4 together with the application of student 6, which was on hold. It holds both applications.

Hold	New applicants		School		Hold	Reject
1 3		→	Clair	→	1 3	
6 4	4	→	Erie	→	6 4	
5		→	Huron	→	5	
2		→	Ontario	→	2	

Final assignment: No application is rejected at Step 5. Based on this method, the final allocations are:

Student	1	2	3	4	5	6
School	Clair	Ontario	Clair	Erie	Huron	Erie

Quiz

Please find the correct allocation for the instance explained below. You will earn ¥100 for a correct answer.

There are 6 students (ID numbers from 1 to 6), and 3 schools (school A, school B and school C) with two places each. Students 2 and 3 live in the district of School A, students 4 and 5 live in the district of School B and, finally, students 1 and 6 live in the district of School C.

School	District Residents	
A	2	3
B	4	5
C	1	6

The lottery determined the following order (student IDs): 5 - 6 - 2 - 1 - 3 - 4.

Each student submitted a school ranking. These are given on the **Quiz** page on your computer screen.

You have up to 10 minutes to determine the final allocation. If you have any questions raise your hand and we will come to you. However, the experimenter will not assist you with the task.

After completing this quiz you will have up to 20 minutes to complete the main school allocation task. Complete the task at your own pace.

After the allocation task there will be a short questionnaire. When you have completed the questionnaire raise your hand and the experimenter will come over to conclude the experiment.

Appendix C.2. Instructions for RDA

This is an experiment in the economics of decision making. The instructions are simple, and if you follow them carefully and make good decisions, you might earn a considerable amount of money (in addition to a ¥700 participation fee). In this experiment, we simulate a procedure to allocate students to schools. The procedure, payment rules, and student allocation method are described below. Do not communicate with each other during the experiment. If you have questions at any point during the experiment, raise your hand and the experimenter will help you.

Procedure

- Please the read these instructions first before proceeding to the computer program. You may consult the instructions at any time during the experiment.
- Each participant is randomly assigned to a group of 4 decision-makers. Each group includes 3 computers and a participant. This means that you are going to interact with 3 computers in this experiment. The computers will act to maximise their expected gain.
- In this simulation, each member of your group acts as a student who is looking for a slot at one of the schools. 4 school slots are available across 4 schools (A, B, C, D) in each group. There is one slot available at each school.
- You will receive a cash payment at the end of the experiment. Your payoff amount depends on the school slot you hold at the end of the experiment. Payoff amounts are going to be outlined on the computer screen.
  NOTE: Different participants and different computers may or may not have different payoff tables. That is, payoff by school may or may not be different for different participants and different computers.
- During the experiment, each participant first completes a quiz which consists of an allocation instance for you to solve. You will have up to 10 minutes to solve it, and will receive ¥100 if you submit the correct answer.
- After you have finished the quiz you may start the school allocation task. You will have up to 20 minutes to complete the school allocation task.
- After all participants have completed the school allocation task, the allocation process starts.
- Once the allocations are determined, each participant will be informed of his/her allocation slot and respective payoff. The school allocation will be performed based on the following school allocation method.

Allocation Method

- In this experiment, students in each group belong to a specific school districts. Your "local school" and those of the computer players are going to be indicated on the computer screen.

NOTE: In this simulation, each school has one slot, but it can happen that more than one student lives in the same district.

- In each group, every student submits a ranking of schools which is used in the following procedure to allocate school places.
- The priority order for each school is separately determined as follows:
  - High Priority Level: Participants who live within the school district.
  - Low Priority Level: Participants who do not live within the school district. The priority among the Low priority students is based on their respective order in a fair lottery. This means each participant has an equal chance of being the first in the line, the second in the line, ..., as well as the last in the line. The computer is going to determine the outcome of this fair lottery. You will be informed about the outcome of the lottery on the screen.
- Once the priorities are determined, the allocation of school slots is obtained as follows:
  - An application to the lowest ranked school on the submitted ranking is sent for each participant.
  - Through out the allocation process, a school can hold no more applications than its number of slots. If a school receives more applications than its capacity, then it rejects the students with lowest priority orders. The remaining applications are retained.
  - Whenever an applicant is rejected at a school, his application is sent to the next lowest school on his/her submitted ranking.
  - Whenever a school receives new applications, these applications are considered together with the retained applications for that school. Among the retained and new applications, the lowest priority ones in excess of the number of the slots are rejected, while remaining applications are retained.
  - The allocation is finalised when no more applications can be rejected. Each participant is assigned a slot at the school that holds his/her application at the end of the process.

An Example

We go through a simple example to illustrate how the allocation method works.

Students and Schools: In this example, there are six students, 1-6, and four schools, Clair, Erie, Huron and Ontario.

Student ID Number: 1, 2, 3, 4, 5, 6	Schools: Clair, Erie, Huron, Ontario

Slots and Residents: There are two slots each at Clair and Erie, and one slot each at Huron and Ontario. Residents of districts are indicated in the table below.

School	Slot 1	Slot 2	District Residents
Clair	☐	☐	1 2
Erie	☐	☐	3 4
Huron	☐		5
Ontario	☐		6

Lottery: The lottery produces the following order.

1 - 2 - 3 - 4 - 5 - 6

Submitted School Rankings: The students submit the following school rankings:

	Last Choice	3rd Choice	2nd Choice	1st Choice
Student 1	Huron	Clair	Ontario	Erie
Student 2	Huron	Ontario	Clair	Erie
Student 3	Ontario	Clair	Erie	Huron
Student 4	Huron	Clair	Ontario	Erie
Student 5	Ontario	Huron	Clair	Erie
Student 6	Clair	Erie	Ontario	Huron

Lottery: School priorities first depend on whether the school is a district school, and next on the lottery order:

	Resident	Non-Resident
Priority order at Clair:	1 - 2	- 3 - 4 - 5 - 6
Priority order at Erie:	3 - 4	- 1 - 2 - 5 - 6
Priority order at Huron:	5	- 1 - 2 - 3 - 4 - 6
Priority order at Ontario:	6	- 1 - 2 - 3 - 4 - 5

This allocation method consists of the following steps:

Step 1: Each student applies to his/her last choice: students 1, 2 and 4 apply to Huron, students 3 and 5 apply to Ontario, and student 6 applies to Clair.

- Clair holds the application of student 6.
- Huron holds the application of student 1 and rejects students 2 and 4.
- Ontario holds the application of student 3 and rejects student 5.

Applicants		School		Hold	Reject
6	→	Clair	→	[6] [ ]	
	→	Erie	→	[ ] [ ]	
1, 2, 4	→	Huron	→	[1]	2, 4
3, 5	→	Ontario	→	[3]	5

Step 2: Each student rejected in Step 1 applies to his/her next lowest choice: student 2 applies to Ontario, student 4 applies to Clair, and student 5 applies to Huron.

- Clair considers the application of student 4 together with the application of student 6, which was on hold. It holds both applications.
- Huron considers the application of student 5 together with the application of student 1, which was on hold. It holds the application of student 5 and rejects student 1.
- Ontario considers the application of student 2 together with the application of student 3, which was on hold. It holds the application of student 2 and rejects student 3.

Hold	New applicants		School		Hold	Reject
6	4	→	Clair	→	6 4	
		→	Erie	→		
1	5	→	Huron	→	5	1
3	2	→	Ontario	→	2	3

Step 3: Each student rejected in Step 2 applies to his/her next lowest choice: Students 1 and 3 apply to Clair.

- Clair considers the applications of students 1 and 3 together with the applications of students 4 and 6, which were on hold. It holds the applications of students 1 and 3 and rejects students 4 and 6.

Hold	New applicants		School		Hold	Reject
6 4	1, 3	→	Clair	→	1 3	4, 6
		→	Erie	→		
5		→	Huron	→	5	
2		→	Ontario	→	2	

Step 4: Each student rejected in Step 3 applies to his/her next lowest choice: Student 4 applies to Ontario and student 6 applies to Erie.

- Ontario considers the application of student 4 together with the application of student 2, which was on hold. It holds the application of student 2 and rejects student 4.
- Erie holds the application of student 6.

Hold	New applicants		School		Hold	Reject
1 3		→	Clair	→	1 3	
	6	→	Erie	→	6	
5		→	Huron	→	5	
2	4	→	Ontario	→	2	4

Step 5: Each student rejected in Step 4 applies to his/her next lowest choice: student 4 applies to Erie.

- Erie considers the application of student 4 together with the application of student 6, which was on hold. It holds both applications.

Hold	New applicants		School		Hold	Reject
[1] [3]		→	Clair	→	[1] [3]	
[6] [4]	4	→	Erie	→	[6] [4]	
[5]		→	Huron	→	[5]	
[2]		→	Ontario	→	[2]	

Final assignment: No application is rejected at Step 5. Based on this method, the final allocations are:

Student	1	2	3	4	5	6
School	Clair	Ontario	Clair	Erie	Huron	Erie

Quiz

Please find the correct allocation for the instance explained below. You will earn ¥100 for a correct answer.

There are 6 students (ID numbers from 1 to 6), and 3 schools (school A, school B and school C) with two places each. Students 2 and 3 live in the district of School A, students 4 and 5 live in the district of School B and, finally, students 1 and 6 live in the district of School C.

School	District Residents	
A	2	3
B	4	5
C	1	6

The lottery determined the following order (student IDs): 5 - 6 - 2 - 1 - 3 - 4.

Each student submitted a school ranking. These are given on the **Quiz** page on your computer screen.

You have up to 10 minutes to determine the final allocation. If you have any questions raise your hand and we will come to you. However, the experimenter will not assist you with the task.

After completing this quiz you will have up to 20 minutes to complete the main school allocation task. Complete the task at your own pace.

After the allocation task there will be a short questionnaire. When you have completed the questionnaire raise your hand and the experimenter will come over to conclude the experiment.

Appendix C.3. Instructions for TTC

This is an experiment in the economics of decision making. The instructions are simple, and if you follow them carefully and make good decisions, you might earn a considerable amount of money (in addition to a ¥700 participation fee). In this experiment, we simulate a procedure to allocate students to schools. The procedure, payment rules, and student allocation method are described below. Do not communicate with each other during the experiment. If you have questions at any point during the experiment, raise your hand and the experimenter will help you.

Procedure

- Please the read these instructions first before proceeding to the computer program. You may consult the instructions at any time during the experiment.
- Each participant is randomly assigned to a group of 4 decision-makers. Each group includes 3 computers and a participant. This means that you are going to interact with 3 computers in this experiment. The computers will act to maximise their expected gain.

- In this simulation, each member of your group acts as a student who is looking for a slot at one of the schools. 4 school slots are available across 4 schools (A, B, C, D) in each group. There is one slot available at each school.

- You will receive a cash payment at the end of the experiment. Your payoff amount depends on the school slot you hold at the end of the experiment. Payoff amounts are going to be outlined on the computer screen.
  NOTE: Different participants and different computers may or may not have different payoff tables. That is, payoff by school may or may not be different for different participants and different computers.

- During the experiment, each participant first completes a quiz which consists of an allocation instance for you to solve. You will have up to 10 minutes to solve it, and will receive ¥100 if you submit the correct answer.

- After you have finished the quiz you may start the school allocation task. You will have up to 20 minutes to complete the school allocation task.

- After all participants have completed the school allocation task, the experimenter starts the allocation process.

- Once the allocations are determined, the experimenter informs each participant of his/her allocation slot and respective payoff. The school allocation will be performed based on the following school allocation method.

Allocation Method

- In this experiment, students in each group belong to a specific school district. Your "local school" and those of the computer players are going to be indicated on the computer screen.
  NOTE: In this simulation, each school has one slot, but it can happen that more than one student lives in the same district.

- In each group, every student submits a ranking of schools which is used in the following procedure to allocate school places.

- Each student is first tentatively assigned to the school within his/her respective district.

  Next, the submitted rankings are used to determine the school allocation through exchanges. The order in which these exchanges are considered is

determined by a fair lottery. This means each student has an equal chance of being the first in the line, the second in the line, ..., as well as the last in the line. You are going to receive information about the outcome of the lottery on the screen.

- The specific allocation process is explained below.
  - Initially all slots are available for allocation.
  - All students are ordered in a queue based on the order in the lottery.
  - Next, an application to the highest ranked school in the submitted ranking is submitted for the student at the top of the queue.
    - If the application is submitted to his district school, then his tentative assignment is finalised (thus he is assigned a slot at his district school). The student and his assignment are removed from subsequent allocations. The process continues with the next student in line.
    - If the application is submitted to another school, say school B, and that school has a vacant slot (it has no other student tentatively assigned), then the requester is assigned to school B. The student and his assignment are removed from subsequent allocations. The process continues with the next student in line.
    - If the application is submitted to another school, say school C, and that school has no vacant slot (it has another student tentatively assigned), then the first student in the queue who tentatively holds a slot at School C is moved to the top of the queue directly in front of the requester.
  - Whenever the queue is modified, the process continues similarly: An application is submitted to the highest ranked school with available slots for the student at the top of the queue.
    - If the application is submitted to his district school, then his tentative assignment is finalised. The process continues with the next student in line.
    - If the application is submitted to another school, say school B, and that school has a vacant slot (it has no other student tentatively assigned), then the requester is assigned to school B. The student and his assignment are removed from subsequent allocations. The process continues with the next student in line.

    - If the application is submitted to another school, say school C, and that school has no vacant slot (it has another student tentatively assigned), then the first student in the queue who tentatively holds a slot at school C is moved to the top of the queue directly in front of the requester. This way, each student is guaranteed an assignment based on the preferences indicated in the submitted ranking.
  - An exchange is obtained when a cycle of applications are made in sequence, e.g., I apply to John's district school, John applies to your district school, and you apply to my district school. In this case, the exchange is completed and the students as well as their assignments are removed from subsequent allocations.
  - The process continues until all students are assigned a school slot.

An Example

We go through a simple example to illustrate how the allocation method works.

Students and Schools: In this example, there are six students, 1-6, and four schools, Clair, Erie, Huron and Ontario.

Student ID Number: 1, 2, 3, 4, 5, 6	Schools: Clair, Erie, Huron, Ontario

Slots and Residents: There are two slots each at Clair and Erie, and one slot each at Huron and Ontario. Residents of districts are indicated in the table below.

School	Slot 1	Slot 2	District Residents
Clair	☐	☐	1 2
Erie	☐	☐	3 4
Huron	☐		5
Ontario	☐		6

Tentative assignments: Students are tentatively assigned slots at their district schools.

School	Slot 1	Slot 2	
Clair	1	2	Students 1 and 2 are **tentatively assigned** a slot at Clair;
Erie	3	4	Students 3 and 4 are **tentatively assigned** a slot at Erie;
Huron	5	-	Student 5 is **tentatively assigned** a slot at Huron;
Ontario	6	-	Students 6 is **tentatively assigned** a slot at Ontario.

Lottery: The lottery produces the following order.

1 - 2 - 3 - 4 - 5 - 6

Submitted School Rankings: The students submit the following school rankings:

	1st Choice	2nd Choice	3rd Choice	Last Choice
Student 1	Huron	Clair	Ontario	Erie
Student 2	Huron	Ontario	Clair	Erie
Student 3	Ontario	Clair	Erie	Huron
Student 4	Huron	Clair	Ontario	Erie
Student 5	Ontario	Huron	Clair	Erie
Student 6	Clair	Erie	Ontario	Huron

This allocation method consists of the following steps:

Step 1: A fair lottery determines the following student order: 1-2-3-4-5-6. Student 1 has ranked Huron as his first choice. However, the only slot at Huron is tentatively held by student 5. So student 5 is moved to the top of the queue.

Step 2: The modified queue is now 5-1-2-3-4-6. Student 5 has ranked Ontario as his first choice. However, the only slot at Ontario is tentatively held by student 6. So student 6 is moved to the top of the queue.

Step 3: The modified queue is now 6-5-1-2-3-4. Student 6 has ranked Clair as her first choice. The two slots at Clair are tentatively held by students 1 and 2. Between the two, student 1 is ahead in the queue. So student 1 is moved to the top of the queue.

Step 4: The modified queue is now 1-6-5-2-3-4. Remember that student 1 has ranked Huron as his first choice. A cycle of applications is now made in sequence in the last three steps: student 1 applied to the tentative assignment of student 5, student 5 applied to the tentative assignment of student 6, and student 6 applied to the tentative assignment of student 1. These exchanges are carried out: student 1 is assigned a slot at Huron, student 5 is assigned a slot at Ontario, and student 6 is assigned a slot at Clair. These students as well as their assignments are removed from the system.

Step 5: The modified queue is now 2-3-4. There is one slot left at Clair and two slots left at Erie. Student 2 applies to Clair, which is her first choice between the two schools with remaining slots. Since student 2 tentatively holds a slot at Clair, her tentative assignment is finalised. Student 2 and her assignment are removed from the system.

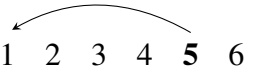
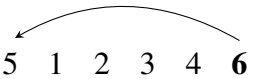
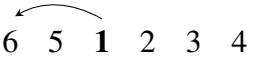
Step 6: The modified queue is now 3-4. There are two slots left at Erie. Student 3 applies to Erie, which is the only school with available slots. Since Student 3 tentatively holds a slot at Erie, her tentative assignment is finalised. Student 3 and her assignment are removed from the system.

Step 7: The only remaining student is student 4. There is one slot left at Erie. Student 4 applies to Erie for the last available slot. Since Student 4 tentatively holds a slot at Erie, his tentative assignment is finalised. Student 4 and his assignment are removed from the system.

Final assignment: Based on this method, the final allocations are:

Student	1	2	3	4	5	6
School	Huron	Clair	Erie	Erie	Ontario	Clair

Illustration

	Queue	Available Slots	The top student in the queue applies to a school.	At the end of the step
Step 1	1-2-3-4-5-6	Clair Clair Erie Erie Huron Ontario	1 applies to her first choice Huron, which is tentatively assigned to 5.	5 comes to the top. 
Step 2	5-1-2-3-4-6	Clair Clair Erie Erie Huron Ontario	5 applies to her first choice Ontario, which is tentatively assigned to 6.	6 comes to the top. 
Step 3	6-5-1-2-3-4	Clair Clair Erie Erie Huron Ontario	6 applies to her first choice Clair, which is tentatively assigned to 1 and 2.	1 comes to the top. 
Step 4	1-6-5-2-3-4	Clair Clair Erie Erie Huron Ontario	A cycle happens in the last 3 steps.	1 gets a slot at Huron. 5 gets a slot at Ontario. 6 gets a slot at Clair.
Step 5	2-3-4	Clair Erie Erie	2 applies to her 3rd choice Clair, because her first and 2nd choices (Huron and Ontario) are no longer available.	2 gets a slot at Clair, because she is a resident in Clair.
Step 6	3-4	Erie Erie	3 applies to Erie which is still available.	3 gets a slot at Erie, because he is a resident in Erie.
Step 7	4	Erie	4 applies to Erie.	4 gets a slot at Erie, because she is a resident in Erie.

Final assignment: Based on this method, the final allocations are:

Student	1	2	3	4	5	6
School	Huron	Clair	Erie	Erie	Ontario	Clair

Quiz

Please find the correct allocation for the instance explained below. You will earn ¥100 for a correct answer.

There are 6 students (ID numbers from 1 to 6), and 3 schools (school A, school B and school C) with two places each. Students 2 and 3 live in the district of School A, students 4 and 5 live in the district of School B and, finally, students 1 and 6 live in the district of School C.

School	District Residents	
A	2	3
B	4	5
C	1	6

The lottery determined the following order (student IDs): 5 - 6 - 2 - 1 - 3 - 4.

Each student submitted a school ranking. These are given on the **Quiz** page on your computer screen.

You have up to 10 minutes to determine the final allocation. If you have any questions raise your hand and we will come to you. However, the experimenter will not assist you with the task.

After completing this quiz you will have up to 20 minutes to complete the main school allocation task. Complete the task at your own pace.

After the allocation task there will be a short questionnaire. When you have completed the questionnaire raise your hand and the experimenter will come over to conclude the experiment.

Appendix C.4. Instructions for RTTC

This is an experiment in the economics of decision making. The instructions are simple, and if you follow them carefully and make good decisions, you might earn a considerable amount of money (in addition to a ¥700 participation fee). In this experiment, we simulate a procedure to allocate students to schools. The procedure, payment rules, and student allocation method are described below. Do not communicate with each other during the experiment. If you have questions at any point during the experiment, raise your hand and the experimenter will help you.

Procedure

- Please the read these instructions first before proceeding to the computer program. You may consult the instructions at any time during the experiment.
- Each participant is randomly assigned to a group of 4 decision-makers. Each group includes 3 computers and a participant. This means that you are going to interact with 3 computers in this experiment. The computers will act to maximise their expected gain.
- In this simulation, each member of your group acts as a student who is looking for a slot at one of the schools. 4 school slots are available across 4 schools (A, B, C, D) in each group. There is one slot available at each school.
- You will receive a cash payment at the end of the experiment. Your payoff amount depends on the school slot you hold at the end of the experiment. Payoff amounts are going to be outlined on the computer screen.

  NOTE: Different participants and different computers may or may not have different payoff tables. That is, payoff by school may or may not be different for different participants and different computers.
- During the experiment, each participant first completes a quiz which consists of an allocation instance for you to solve. You will have up to 10 minutes to solve it, and will receive ¥100 if you submit the correct answer.
- After you have finished the quiz you may start the school allocation task. You will have up to 20 minutes to complete the school allocation task.
- After all participants have completed the school allocation task, the experimenter starts the allocation process.
- Once the allocations are determined, the experimenter informs each participants of his/her allocation slot and respective payoff. The school allocation will be performed based on the following school allocation method.

Allocation Method

- In this experiment, students in each group belong to a specific school districts. Your "local school" and those of the computer players are going to be indicated on the computer screen.

NOTE: In this simulation, each school has one slot, but it can happen that more than one student lives in the same district.

- In each group, every student submits a ranking of schools which is used in the following procedure to allocate school places.
- Each student is first tentatively assigned to the school within his/her respective district.

  Next, the submitted rankings are used to determine the school allocation through exchanges. The order in which these exchanges are considered is determined by a fair lottery. This means each student has an equal chance of being the first in the line, the second in the line, ..., as well as the last in the line. You are going to receive information about the outcome of the lottery on the screen.
- The specific allocation process is explained below.
  - Initially all slots are available for allocation.
  - All students are ordered in a queue based on the order in the lottery.
  - Next, an application to the lowest ranked school in the submitted ranking is submitted for the student at the top of the queue.
    - If the application is submitted to his district school, then his tentative assignment is finalised (thus he is assigned a slot at his district school). The student and his assignment are removed from subsequent allocations. The process continues with the next student in line.
    - If the application is submitted to another school, say school B, and that school has a vacant slot (it has no other student tentatively assigned), then the requester is assigned to school B. The student and his assignment are removed from subsequent allocations. The process continues with the next student in line.
    - If the application is submitted to another school, say school C, and that school has no vacant slot (it has another student tentatively assigned), then the first student in the queue who tentatively holds a slot at School C is moved to the top of the queue directly in front of the requester.

- Whenever the queue is modified, the process continues similarly: An application is submitted to the lowest ranked school with available slots for the student at the top of the queue.
  - If the application is submitted to his district school, then his tentative assignment is finalised. The process continues with the next student in line.
  - If the application is submitted to another school, say school B, and that school has a vacant slot (it has no other student tentatively assigned), then the requester is assigned to school B. The student and his assignment are removed from subsequent allocations. The process continues with the next student in line.
  - If the application is submitted to another school, say school C, and that school has no vacant slot (it has another student tentatively assigned), then the first student in the queue who tentatively holds a slot at school C is moved to the top of the queue directly in front of the requester. This way, each student is guaranteed an assignment based on the preferences indicated in the submitted ranking.
- An exchange is obtained when a cycle of applications are made in sequence, e.g., I apply to John's district school, John applies to your district school, and you apply to my district school. In this case, the exchange is completed and the students as well as their assignments are removed from subsequent allocations.
- The process continues until all students are assigned a school slot.

An Example

We go through a simple example to illustrate how the allocation method works.

Students and Schools: In this example, there are six students, 1-6, and four schools, Clair, Erie, Huron and Ontario.

Student ID Number: 1, 2, 3, 4, 5, 6	Schools: Clair, Erie, Huron, Ontario

Slots and Residents: There are two slots each at Clair and Erie, and one slot each at Huron and Ontario. Residents of districts are indicated in the table below.

School	Slot 1	Slot 2	District Residents
Clair	☐	☐	1 2
Erie	☐	☐	3 4
Huron	☐		5
Ontario	☐		6

Tentative assignments: Students are tentatively assigned slots at their district schools.

School	Slot 1	Slot 2	
Clair	1	2	Students 1 and 2 are **tentatively assigned** a slot at Clair;
Erie	3	4	Students 3 and 4 are **tentatively assigned** a slot at Erie;
Huron	5	-	Student 5 is **tentatively assigned** a slot at Huron;
Ontario	6	-	Students 6 is **tentatively assigned** a slot at Ontario.

Lottery: The lottery produces the following order.

1 - 2 - 3 - 4 - 5 - 6

Submitted School Rankings: The students submit the following school rankings:

	Last Choice	3rd Choice	2nd Choice	1st Choice
Student 1	Huron	Clair	Ontario	Erie
Student 2	Huron	Ontario	Clair	Erie
Student 3	Ontario	Clair	Erie	Huron
Student 4	Huron	Clair	Ontario	Erie
Student 5	Ontario	Huron	Clair	Erie
Student 6	Clair	Erie	Ontario	Huron

This allocation method consists of the following steps:

Step 1: A fair lottery determines the following student order: 1-2-3-4-5-6. Student 1 has ranked Huron as his last choice. However, the only slot at Huron is tentatively held by student 5. So student 5 is moved to the top of the queue.

Step 2: The modified queue is now 5-1-2-3-4-6. Student 5 has ranked Ontario as his last choice. However, the only slot at Ontario is tentatively held by student 6. So student 6 is moved to the top of the queue.

Step 3: The modified queue is now 6-5-1-2-3-4. Student 6 has ranked Clair as her last choice. The two slots at Clair are tentatively held by students 1 and 2. Between the two, student 1 is ahead in the queue. So student 1 is moved to the top of the queue.

Step 4: The modified queue is now 1-6-5-2-3-4. Remember that student 1 has ranked Huron as his last choice. A cycle of applications is now made in sequence in the last three steps: student 1 applied to the tentative assignment of student 5, student 5 applied to the tentative assignment of student 6, and student 6 applied to the tentative assignment of student 1. These exchanges are carried out: student 1 is assigned a slot at Huron, student 5 is assigned a slot at Ontario, and student 6 is assigned a slot at Clair. These students as well as their assignments are removed from the system.

Step 5: The modified queue is now 2-3-4. There is one slot left at Clair and two slots left at Erie. Student 2 applies to Clair, which is her last choice between the two schools with remaining slots. Since student 2 tentatively holds a slot at Clair, her tentative assignment is finalised. Student 2 and her assignment are removed from the system.

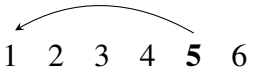
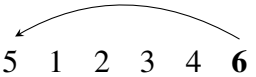
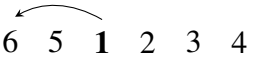
Step 6: The modified queue is now 3-4. There are two slots left at Erie. Student 3 applies to Erie, which is the only school with available slots. Since Student 3 tentatively holds a slot at Erie, her tentative assignment is finalised. Student 3 and her assignment are removed from the system.

Step 7: The only remaining student is student 4. There is one slot left at Erie. Student 4 applies to Erie for the last available slot. Since Student 4 tentatively holds a slot at Erie, his tentative assignment is finalised. Student 4 and his assignment are removed from the system.

Final assignment: Based on this method, the final allocations are:

Student	1	2	3	4	5	6
School	Huron	Clair	Erie	Erie	Ontario	Clair

Illustration

	Queue	Available Slots	The top student in the queue applies to a school.	At the end of the step
Step 1	1-2-3-4-5-6	Clair Clair Erie Erie Huron Ontario	1 applies to her last choice Huron, which is tentatively assigned to 5.	5 comes to the top. 
Step 2	5-1-2-3-4-6	Clair Clair Erie Erie Huron Ontario	5 applies to her last choice Ontario, which is tentatively assigned to 6.	6 comes to the top. 
Step 3	6-5-1-2-3-4	Clair Clair Erie Erie Huron Ontario	6 applies to her last choice Clair, which is tentatively assigned to 1 and 2.	1 comes to the top. 
Step 4	1-6-5-2-3-4	Clair Clair Erie Erie Huron Ontario	A cycle happens in the last 3 steps.	1 gets a slot at Huron. 5 gets a slot at Ontario. 6 gets a slot at Clair.
Step 5	2-3-4	Clair Erie Erie	2 applies to her 2nd choice Clair, because her last and 3rd choices (Huron and Ontario) are no longer available.	2 gets a slot at Clair, because she is a resident in Clair.
Step 6	3-4	Erie Erie	3 applies to Erie which is still available.	3 gets a slot at Erie, because he is a resident in Erie.
Step 7	4	Erie	4 applies to Erie.	4 gets a slot at Erie, because she is a resident in Erie.

Final assignment: Based on this method, the final allocations are:

Student	1	2	3	4	5	6
School	Huron	Clair	Erie	Erie	Ontario	Clair

Quiz

Please find the correct allocation for the instance explained below. You will earn ¥100 for a correct answer.

There are 6 students (ID numbers from 1 to 6), and 3 schools (school A, school B and school C) with two places each. Students 2 and 3 live in the district of School A, students 4 and 5 live in the district of School B and, finally, students 1 and 6 live in the district of School C.

School	District Residents	
A	2	3
B	4	5
C	1	6

The lottery determined the following order (student IDs): 5 - 6 - 2 - 1 - 3 - 4.

Each student submitted a school ranking. These are given on the **Quiz** page on your computer screen.

You have up to 10 minutes to determine the final allocation. If you have any questions raise your hand and we will come to you. However, the experimenter will not assist you with the task.

After completing this quiz you will have up to 20 minutes to complete the main school allocation task. Complete the task at your own pace.

After the allocation task there will be a short questionnaire. When you have completed the questionnaire raise your hand and the experimenter will come over to conclude the experiment.