Constrained School Choice: An Experimental Study

Web Appendix

Not for Publication

Contents

I. Behavior

A. Suboptimal play

Table 1 below displays the proportions of subjects preserving the relative ranking of the schools that appear above the district school for the low and high-district, respectively. Most of the differences between the unconstrained and constrained cases are not significant, although we can see that the raise for the low-district subjects is higher than that of the high-district subjects. That is, low-district subjects seem to be more sensitive to the presence of the constraint.

When comparing TTC and SOSM the differences are more significant in the unconstrained case than in the constrained case.[1] If we do the analysis for the high and low-district school samples we find that the high-district sample exhibits slightly less suboptimal play.[2]

	Low-district sample		High-district sample	
	Constrained	Unconstrained	Constrained	Unconstrained
SOSM_d	95.2	57.1	96.7	96.7
SOSM_r	88.6	81.8	96.4	82.1
TTC_d	90.5	78.6	96.7	93.3
TTC_r	90.9	86.4	89.3	92.9

Table 1: Preserving the original ranking — high and low district samples

For SOSM and TTC constraining the choice leads to a higher proportion of subjects preserving the schools' relative rankings in their choices. An explanation leading to this results would be that the higher complexity of deciding which schools to include *and* how to rank them causes the students to only think about which schools to include and simply maintain the relative ranking of the true preferences by default. In the case of TTC and SOSM this would lead

[1] The t-statistics (p-values) are .7239 (.2352) for SOSM_d vs. TTC_d and 1.31 (.0962) for SOSM_r vs. TTC_r for the constrained case, and 1.6456 (.0510) for SOSM_d vs. TTC_d and 1.1781 (.1204) for SOSM_r vs. TTC_r for the unconstrained case. An argument that has been raised is that the complexity may make the mechanism harder to manipulate. TTC is more complex and therefore may be harder to manipulate.

[2] Table 1 in the web-Appendix shows the numbers.

to the proportion of subjects respecting the original ranking being also higher in the constrained case. But for Boston, the different explanations would lead to different results. If subjects are optimizing they should not necessarily respect the ranking. But if the underlying behavioral explanation was that they focus only on which ones to include and respect the ranking by default we would have that the number of subjects respecting the original ranking should also be significantly larger in the constrained setting. Table 2 displays the proportions of subjects preserving the original ranking of schools in their choice lists for the constrained and unconstrained setups.

	Constrained	Unconstrained	t-stat	p-value
BOS_d	34.7	37.5	0.35	0.37
BOS_r	37.5	44.4	0.84	0.2

Table 2: Preserving original ranking in BOS — full sample

From the results we see that the preserving of ranking is *not* higher for BOS in the constrained case.

	Constrained	Unconstrained	t-stat	p-value
BOS_d	18.1	18.1	0	.5
BOS_r	8.3	22.2	2.3442	.0102
SOSM_d	25.0	58.3	4.2805	.000
SOSM_r	18.1	56.9	5.2262	.000
TTC_d	22.2	62.5	5.3184	.000
TTC_r	19.4	73.6	7.7051	.000

Table 3: Truncated-truthtelling — full sample

B. Safety school effect

The Safety School Effect characterizes a *safe* strategy for an individual under TTC or SOSM. We say that a subject's choice exhibits a *Safety School Effect* (SSE) whenever the district

school is ranked below the 3rd position in the preferences but appears in the first 3 positions in the submitted list. Note that this effect only concerns subjects in the low-district sample. For both SOSM and TTC the district school is a safe option since, if included in the list, the individual is guaranteed one of its seats. So including it secures the individual from being left unassigned. This effect may not be observed for individuals who do not value their district school (have their district school as one of the worst in the original ranking) and therefore, although it is a secure option, it is bad enough for them to want to take risks by including some other more preferred school.

For BOS incentives are not as large, since only including the district school as a first choice guarantees not being left unassigned. In order for that to be a desirable strategy then, it has to be the case that the district school is a very nice option, since the individual is committing to it when putting it as a first option. We therefore expect SSE to be smaller for BOS than for SOSM and TTC.

Safety School Effect *For SOSM, TTC and BOS there is a significant increase in the proportion of individuals exhibiting SSE in the constrained with respect to the unconstrained case.*

It turns out that the proportion of individuals exhibiting the SSE is identical to the number of low-district subject exhibiting DSB (Table 3 in the paper). For the constrained case they are identical by definition. For the unconstrained case it implies that the move upward in the ranking of the district school for subjects in the low district sample is always to one of the first three positions. The first three positions seem to be focal to most subjects.

Table 4 shows the percentage of subjects exhibiting SSE classified by the rank of the district school in their preferences. In the unconstrained case, if the district school is ranked 5th or higher there is still a non-negligible proportion of subjects exhibiting a SSE, but this percentage drops when we focus on subjects with the district school in the 6th position, and goes to 0 when the district school is the worse school (in the unconstrained case the worse school's payoff is guaranteed, and subjects understand that). For the constrained case the SSE is extremely high whenever the district school ranks 5th or higher in the preferences. We observe a considerable decline when the district school is the least desirable school, but the proportion is still surpris-

ingly high.[3] Even if the school gives them a very small payoff still half of the subjects want to protect themselves from the 0 payoff by including the district school in the choice list instead of a considerably more desirable school. Overall then, the SSE seems to be extremely large for most of the subjects, except for those subjects for which the district school is the worst school. This suggests that participants are very risk-averse and opt for using "protective strategies" (see Barberá and Dutta (1995).

Rank of district	4 or 5		6		7	
	Cons.	Uncons.	Cons.	Uncons.	Cons.	Uncons.
BOS_d	92.9	82.1	62.5	12.5	50.0	0
BOS_r	89.3	67.9	58.3	25.0	25.0	0
$SOSM_d$	92.9	17.9	100	0	66.6	0
$SOSM_r$	96.4	21.4	83.3	16.6	50.0	0
TTC_d	92.9	17.9	100	12.5	33.3	0
TTC_r	96.4	14.3	75.0	0	75.0	0

Table 4: Decomposition of the Safety School Effect — full sample

II. The recombinant estimator

Recall that for each of the sessions there are 36 different players. We run the recombinations by fixing player 1 and randomly choosing the other 35 players from the two sessions. That is, player 2 is chosen randomly between player 2 from the two sessions, player 3 is chosen randomly between the two players 3 from the two sessions, and so on. For each strategy profile constructed in this manner the outcome of the game is computed (either the mean payoff or the

[3]There are 6 and 4 subjects ranking the district school 7th in their preferences in the designed and random environments, respectively. When the district school is ranked 6th in the preferences the sample size is 8 and 12 for the designed and random environments, respectively. There are 28 subjects ranking the district school either 4th or 5th in their preferences for both the designed and random environments.

number of blocking pairs). We repeat this step 200,000 times for this particular player.[4] Next, repeat the procedure by picking the strategy of the first subject from the second session, and so on, until we have done so for all subjects from all sessions.

The estimator is obtained as follows. Consider one of the 6 treatments, and for each of its $2 \times 36 \times 200,000$ artificial sessions, let $Y(i,j,l)$ be the outcome (mean payoff or number of blocking pairs) of the l-th artificial session created by fixing player j from session i. The estimated mean payoff over all recombinations is given by:

$$\hat{\mu} = \frac{1}{14,400,000} \sum_{i=1}^{2} \sum_{j=1}^{36} \sum_{l=1}^{200,000} Y(i,j,l)\,. \tag{1}$$

The estimated variance in payoffs is then given by:

$$\sigma^2 = \frac{1}{14,400,000} \sum_{i=1}^{2} \sum_{j=1}^{36} \sum_{l=1}^{200,000} \left[Y(i,j,l) - \hat{\mu}\right]^2\,. \tag{2}$$

To compute the covariance, split each of the 200,000 recombinations $(i,j,\cdot)$ in two sets of 100,000 recombinations, and compute the covariance across these two sets, i.e.,

$$\phi = \frac{1}{7,200,000} \sum_{i=1}^{2} \sum_{j=1}^{36} \sum_{l=1}^{100,000} \left[Y(i,j,l) - \hat{\mu}\right] \times \left[Y(i,j,l+100,000) - \hat{\mu}\right]. \tag{3}$$

The asymptotic variance can then be estimated using Eq. (6.5) of Mullin and Reiley (2006),

$$var(\hat{\mu}) \approx \frac{\sigma^2}{36 \times 200,000 \times 2} + \frac{36\phi}{2}\,. \tag{4}$$

[4]Mullin and Reiley (2006) recommend repeating the recombinations at least 100 times for each of the 2×36 subjects. But for this particular game the number of recombinations required to obtain robust statistics is significantly larger. See Calsamiglia, Haeringer and Klijn (2008) for further details.

References

Barberá, Salvador, Bhaskar Dutta. 1995. "Protective Behavior in Matching Models," *Games and Economic Behavior*, 8: 281–296.

Calsamiglia, Caterina, Guillaume Haeringer and Flip Klijn. 2008. "On the Robustness of Recombinant Estimation: Efficiency in School Choice." http://pareto.uab.es/˜caterina/research/NoteCalHaeKli.pdf

Mullin, Charles H., David A. Reiley. 2006. "Recombinant Estimation for Normal-Form Games with Applications to Auctions and Bargaining." *Games and Economic Behavior*, 54: 159-182.

III. Appendix: Experimental instructions - Unconstrained setting

Instructions - Mechanism B

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 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

- There are 36 participants in this experiment. You are participant #1.
- In this simulation, 36 school slots are available across seven schools. These schools differ in size, geographic location, specialty, and quality of instruction in each specialty. Each school slot is allocated to one participant. There are three slots each at schools A and B, and six slots each at schools C, D, E, F and G.
- **Your payoff** amount depends on the school slot you hold at the end of the experiment. Payoff amounts are outlined in the following table. These amounts reflect the desirability of the school in terms of location, specialty and quality of instruction.

Slot received at School:	A	B	C	D	E	F	G
Payoff to Participant #1 (in dollars)	13	16	9	2	5	11	7

The table is explained as follows:

  - You will be paid $13 if you hold a slot at school A at the end of the experiment.
  - You will be paid $16 if you hold a slot at school B at the end of the experiment.
  - You will be paid $9 if you hold a slot at school C at the end of the experiment.

  - You will be paid $2 if you hold a slot at school D at the end of the experiment.
  - You will be paid $5 if you hold a slot at school E at the end of the experiment.
  - You will be paid $11 if you hold a slot at school F at the end of the experiment.
  - You will be paid $7 if you hold a slot at school G at the end of the experiment.

  ***NOTE* different participants might have different payoff tables.** That is, payoff by school might be different for different participants.

- During the experiment, each participant first completes the Decision Sheet by indicating school preferences. The Decision Sheet is the last page of this packet. Note that you need to rank all seven schools in order to indicate your preferences.
- After all participants have completed their Decision Sheets, the experimenter collects the Sheets and starts the allocation process.
- Once the allocations are determined, the experimenter informs each participants of his/her allocation slot and respective payoff.

Allocation Method

- In this experiment, participants are defined as belonging to the following school districts.
  - Participants #1 - #3 live within the school district of school A,
  - Participants #4 - #6 live within the school district of school B,
  - Participants #7 - #12 live within the school district of school C,
  - Participants #13 - #18 live within the school district of school D,
  - Participants #19 - #24 live within the school district of school E,
  - Participants #25 - #30 live within the school district of school F,
  - Participants #31 - #36 live within the school district of school G.

- In addition, for each school, a separate **priority order** of the students is determined as follows:
  - **Highest Priority Level:** Participants who rank the school as their first choice AND who also live within the school district.
  - **2nd Priority Level:** Participants who rank the school as their first choice BUT who do not live within the school district.
  - **3rd Priority Level:** Participants who rank the school as their second choice AND who also live within the school district.
  - **4th Priority Level:** Participants who rank the school as their second choice BUT who do not live within the school district.

    ⋮ ⋮
  - **13th Priority Level:** Participants who rank the school as their seventh choice AND who also live within the school district.
  - **Lowest Priority Level:** Participants who rank the school as their seventh choice BUT who do not live within the school district.
- The ties between participants at the same priority level are broken using a fair lottery. This means each participant has an equal chance of being the first in the line, the second in the line, $\cdots$, as well as the last in the line. To determine this fair lottery, a participant will be asked to draw 36 ping pong balls from an urn, one at a time. Each ball has a number on it, corresponding to a participant ID number. The sequence of the draw determines the order in the lottery.
- Therefore, to determine the priority order of a student for a school:
  - The first consideration is how highly the participant ranks the school in his/her Decision Sheet,
  - The second consideration is whether the participant lives within the school district or not, and

- The last consideration is the order in the fair lottery.

- Once the priorities are determined, slots are allocated in seven rounds.

Round 1. a. An application to the first ranked school in the Decision Sheet is sent for each participant.

b. Each school accepts the students with higher priority order until all slots are filled. These students and their assignments are removed from the system. The remaining applications for each respective school are rejected.

Round 2. a. The rejected applications are sent to his/her second ranked school in the Decision Sheet.

b. If a school still has available slots remaining from Round 1, then it accepts the students with higher priority order until all slots are filled. The remaining applications are rejected.

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Round 6. a. The application of each participant who is rejected by his/her top five choices is sent to his/her sixth choice.

b. If a school still has slots available, then it accepts the students with higher priority order until all slots are filled. The remaining applications are rejected.

Round 7. Each remaining participant is assigned a slot at his/her last choice.

An Example:

We will 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.

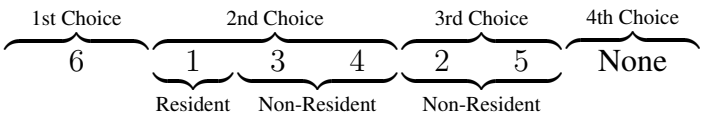
$$\boxed{1-2-3-4-5-6}$$

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

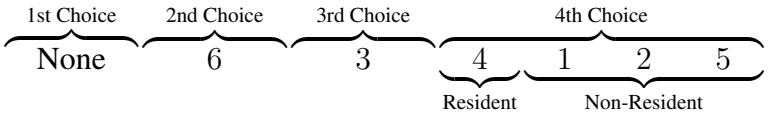
Priority: School priorities depend on: (1) how highly the student ranks the school, (2) whether the school is a district school, and (3) the lottery order.

Clair : Student 6 ranks Clair first. Students 1, 3 and 4 rank Clair second; among them, student 1 lives within the Clair school district. Students 2 and 5 rank Clair third. Using the lottery order to break ties, the priority order for Clair is 6-1-3-4-2-5.

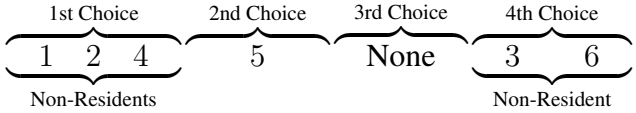


Erie : Student 6 ranks Erie second. Student 3 ranks Erie third. Students 1, 2, 4 and 5 rank Erie fourth; among them student 4 lives within the Erie school district. Using the lottery order

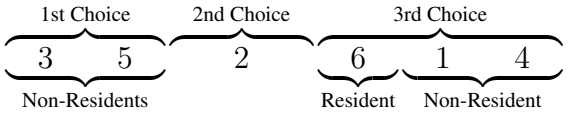
to break ties, the priority for Erie is 6-3-4-1-2-5.



Huron : Students 1, 2 and 4 rank Huron first. Student 5 ranks Huron second. Students 3 and 6 rank Huron fourth. Using the lottery order to break ties, the priority for Huron is 1-2-4-5-3-6.



Ontario : Students 3 and 5 rank Ontario first. Student 2 ranks Ontario second. Students 1, 4 and 6 rank Ontario third; among them student 6 lives within the Ontario school district. Using the lottery order to break ties, the priority for Ontario is 3-5-2-6-1-4.



Allocation: This allocation method consists of the following rounds.

Round 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.

- School Clair accepts Student 6.
- School Huron accepts Student 1 and rejects Students 2,4.
- School Ontario accepts Student 3 and rejects Student 5.

Applicants		School		Accept	Reject		Slot 1	Slot 2
6	$\longrightarrow$	Clair	$\longrightarrow$	6		$\longrightarrow$	$\boxed{6}$	$\square$
	$\longrightarrow$	Erie	$\longrightarrow$			$\longrightarrow$	$\square$	$\square$
1, 2, 4	$\longrightarrow$	Huron	$\longrightarrow$	1	2, 4	$\longrightarrow$	$\boxed{1}$	—
3, 5	$\longrightarrow$	Ontario	$\longrightarrow$	3	5	$\longrightarrow$	$\boxed{3}$	—

Accepted students are removed from the subsequent process.

Round 2 : Each student who is rejected in Round 1 then applies to his/her **second choice**: Student 2 applies to Ontario, student 4 applies to Clair, and student 5 applies to Huron.

- No slot is left at Ontario, so it rejects student 2.
- Clair accepts student 4 for its last slot.
- No slot is left at Huron, so it rejects student 5.

Applicants		School		Accept	Reject		Slot 1	Slot 2
4	$\longrightarrow$	Clair	$\longrightarrow$	4		$\longrightarrow$	$\boxed{6}$	$\boxed{4}$
	$\longrightarrow$	Erie	$\longrightarrow$			$\longrightarrow$	$\square$	$\square$
5	$\longrightarrow$	Huron	$\longrightarrow$		5	$\longrightarrow$	$\boxed{1}$	—
2	$\longrightarrow$	Ontario	$\longrightarrow$		2	$\longrightarrow$	$\boxed{3}$	—

Round 3 : Each student who is rejected in Rounds 1-2 applies to his/her **third choice**: Students 2 and 5 apply to Clair.

- No slot is left at Clair, so it rejects students 2 and 5.

Applicants		School		Accept	Reject		Slot 1	Slot 2
2, 5	$\longrightarrow$	Clair	$\longrightarrow$		2, 5	$\longrightarrow$	$\boxed{6}$	$\boxed{4}$
	$\longrightarrow$	Erie	$\longrightarrow$			$\longrightarrow$	$\square$	$\square$
	$\longrightarrow$	Huron	$\longrightarrow$			$\longrightarrow$	$\boxed{1}$	—
	$\longrightarrow$	Ontario	$\longrightarrow$			$\longrightarrow$	$\boxed{3}$	—

Round 4 : Each remaining student is assigned a slot at his/her **last choice**: Students 2 and 5 receive a slot at Erie.

Applicants		School		Accept	Reject		Slot 1	Slot 2
	$\longrightarrow$	Clair	$\longrightarrow$			$\longrightarrow$	$\boxed{6}$	$\boxed{4}$
2, 5	$\longrightarrow$	Erie	$\longrightarrow$	2, 5		$\longrightarrow$	$\boxed{2}$	$\boxed{5}$
	$\longrightarrow$	Huron	$\longrightarrow$			$\longrightarrow$	$\boxed{1}$	—
	$\longrightarrow$	Ontario	$\longrightarrow$			$\longrightarrow$	$\boxed{3}$	—

Based on this method, the final allocations are:

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

You will have 15 minutes to go over the instructions at your own pace, and make your decisions. Feel free to earn as much cash as you can. Are there any questions?

Decision Sheet - Mechanism B

- Recall: You are participant #1 and you live within the school district of School A .
- Recall: **Your payoff** amount depends on the school slot you hold at the end of the experiment. Payoff amounts are outlined in the following table.

School:	A	B	C	D	E	F	G
Payoff in dollars	13	16	9	2	5	11	7

You will be paid $13 if you hold a slot of School A at the end of the experiment.
You will be paid $16 if you hold a slot of School B at the end of the experiment.
You will be paid $9 if you hold a slot of School C at the end of the experiment.
You will be paid $2 if you hold a slot of School D at the end of the experiment.
You will be paid $5 if you hold a slot of School E at the end of the experiment.
You will be paid $11 if you hold a slot of School F at the end of the experiment.
You will be paid $7 if you hold a slot of School G at the end of the experiment.

Please write down your ranking of the schools (A through G) from your first choice to your last choice. Please rank ALL seven schools.

1st choice	2nd choice	3rd choice	4th choice	5th choice	6th choice	last choice

Your I.D : #1 **Your Name** (print):_____

This is the end of the experiment for you. Please remain seated until the experimenter collects your Decision Sheet.

After the experimenter collects all Decision Sheets, a participant will be asked to draw ping pong balls from an urn to generate a fair lottery. The lottery, as well as all participants' rankings will be entered into a computer after the experiment. The experimenter will inform each participants of his/her allocation slot and respective payoff once it is computed.

Instructions - Mechanism G

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Allocation Method

- In this experiment, participants are defined as belonging to the following school districts.
  - Participants #1 - #3 live within the school district of school A,
  - Participants #4 - #6 live within the school district of school B,
  - Participants #7 - #12 live within the school district of school C,
  - Participants #13 - #18 live within the school district of school D,
  - Participants #19 - #24 live within the school district of school E,
  - Participants #25 - #30 live within the school district of school F,
  - Participants #31 - #36 live within the school district of school G.
- A priority order is determined for each school. Each participant is assigned a slot at the **best possible** school reported in his/her Decision Sheet that is consistent with the priority order below.
- The priority order for each school is separately determined as follows:
  - **High Priority Level:** Participants who live within the school district.

    Since the number of High priority participants at each school is equal to the school capacity, each High priority participant is guaranteed an assignment which is at least as good as his/her district school based on the ranking indicated in his/her Decision Sheet.
  - **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, $\cdots$, as well as the last in the line. To determine this fair

lottery, a participant will be asked to draw 36 ping pong balls from an urn, one at a time. Each ball has a number on it, corresponding to a participant ID number. The sequence of the draw determines the order in the lottery.

- Once the priorities are determined, the allocation of school slots is obtained as follows:
  - An application to the first ranked school in the Decision Sheet 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.
  - Whenever an applicant is rejected at a school, his application is sent to the next highest school on his Decision Sheet.
  - 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 finalized 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 will 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.

$$\boxed{1 - 2 - 3 - 4 - 5 - 6}$$

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

Priority : 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

The 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	$\longrightarrow$	Clair	$\longrightarrow$	$\boxed{6}\square$	
	$\longrightarrow$	Erie	$\longrightarrow$	$\square\square$	
1, 2, 4	$\longrightarrow$	Huron	$\longrightarrow$	$\boxed{1}$ –	2, 4
3, 5	$\longrightarrow$	Ontario	$\longrightarrow$	$\boxed{3}$ –	5

Step 2 : Each student rejected in Step 1 applies to his/her next 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 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 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 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	⟶	Erie	⟶	[6][4]	
[5] –		⟶	Huron	⟶	[5] –	
[2] –		⟶	Ontario	⟶	[2] –	

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

You will have 15 minutes to go over the instructions at your own pace, and make your decisions. Feel free to earn as much cash as you can. Are there any questions?

Decision Sheet - Mechanism G

- Recall: You are participant #1 and you live within the school district of School A .
- Recall: **Your payoff** amount depends on the school slot you hold at the end of the experiment. Payoff amounts are outlined in the following table.

School:	A	B	C	D	E	F	G
Payoff in dollars	13	16	9	2	5	11	7

You will be paid $13 if you hold a slot of School A at the end of the experiment.
You will be paid $16 if you hold a slot of School B at the end of the experiment.
You will be paid $9 if you hold a slot of School C at the end of the experiment.
You will be paid $2 if you hold a slot of School D at the end of the experiment.
You will be paid $5 if you hold a slot of School E at the end of the experiment.
You will be paid $11 if you hold a slot of School F at the end of the experiment.
You will be paid $7 if you hold a slot of School G at the end of the experiment.

Please write down your ranking of the schools (A through G) from your first choice to your last choice. Please rank ALL seven schools.

1st choice	2nd choice	3rd choice	4th choice	5th choice	6th choice	last choice

Your I.D : #1 **Your Name** (print):_____

This is the end of the experiment for you. Please remain seated until the experimenter collects your Decision Sheet.

After the experimenter collects all Decision Sheets, a participant will be asked to draw ping pong balls from an urn to generate a fair lottery. The lottery, as well as all participants' rankings will be entered into a computer after the experiment. The experimenter will inform each participants of his/her allocation slot and respective payoff once it is computed.

Instructions - Mechanism T

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Allocation Method

- In this experiment, participants are defined as belonging to the following school districts.
  - Participants #1 - #3 live within the school district of school A,
  - Participants #4 - #6 live within the school district of school B,
  - Participants #7 - #12 live within the school district of school C,
  - Participants #13 - #18 live within the school district of school D,
  - Participants #19 - #24 live within the school district of school E,
  - Participants #25 - #30 live within the school district of school F,
  - Participants #31 - #36 live within the school district of school G.
- Each participant is first tentatively assigned to the school within his/her respective district. Next, Decision Sheet rankings are used to determine mutually beneficial exchanges between two or more participants. The order in which these exchanges are considered is determined by a fair lottery. This means each participant has an equal chance of being the first in the line, the second in the line, $\cdots$, as well as the last in the line. To determine this fair lottery, a participant will be asked to draw 36 ping pong balls from an urn, one at a time. Each ball has a number on it, corresponding to a participant ID number. The sequence of the draw determines the order in the lottery.
- The specific allocation process is explained below.
  - Initially all slots are available for allocation.
  - All participants are ordered in a queue based on the order in the lottery.
  - Next, an application to the highest ranked school in the Decision Sheet is submitted for the participant at the top of the queue.

* If the application is submitted to his district school, then his tentative assignment is finalized (thus he is assigned a slot at his district school). The participant and his assignment are removed from subsequent allocations. The process continues with the next participant in line.
* If the application is submitted to another school, say school S, then the first participant in the queue who tentatively holds a slot at School S 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 participant at the top of the queue.
  * If the application is submitted to his district school, then his tentative assignment is finalized. The process continues with the next participant in line.
  * If the application is submitted to another school, say school S, then the first participant in the queue who tentatively holds a slot at school S is moved to the top of the queue directly in front of the requester. This way, each participant is guaranteed an assignment which is at least as good as his/her district school based on the preferences indicated in his/her Decision Sheet.

– A mutually-beneficial exchange is obtained when a cycle of applications are made in sequence, which benefits all affected participants, 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 participants as well as their assignments are removed from subsequent allocations.

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

An Example:

We will 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 top 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 top 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 top 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 top 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 mutually beneficial 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 top choice between the two schools with remaining slots. Since student 2 tentatively holds a slot at Clair, her tentative assignment is finalized. 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 finalized. 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 finalized. 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 1st choice Huron, which is tentatively assigned to 5.	5 comes to the top. 1-2-3-4-**5**-6
Step 2	5-1-2-3-4-6	Clair Clair Erie Erie Huron Ontario	5 applies to her 1st choice Ontario which is tentatively assigned to 6.	6 comes to the top. 5-1-2-3-4-**6**
Step 3	6-5-1-2-3-4	Clair Clair Erie Erie Huron Ontario	6 applies to her 1st choice Clair, which is tentatively assigned to 1 and 2.	1 comes to the top. 6-5-**1**-2-3-4
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 1st 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

You will have 15 minutes to go over the instructions at your own pace, and make your decisions. Feel free to earn as much cash as you can. Are there any questions?

Decision Sheet - Mechanism T

- Recall: You are participant #1 and you live within the school district of School A .
- Recall: **Your payoff** amount depends on the school slot you hold at the end of the experiment. Payoff amounts are outlined in the following table.

School:	A	B	C	D	E	F	G
Payoff in dollars	13	16	9	2	5	11	7

You will be paid \$13 if you hold a slot of School A at the end of the experiment.
You will be paid \$16 if you hold a slot of School B at the end of the experiment.
You will be paid \$9 if you hold a slot of School C at the end of the experiment.
You will be paid \$2 if you hold a slot of School D at the end of the experiment.
You will be paid \$5 if you hold a slot of School E at the end of the experiment.
You will be paid \$11 if you hold a slot of School F at the end of the experiment.
You will be paid \$7 if you hold a slot of School G at the end of the experiment.

Please write down your ranking of the schools (A through G) from your first choice to your last choice. Please rank ALL seven schools.

1st choice	2nd choice	3rd choice	4th choice	5th choice	6th choice	last choice

Your I.D : #1 **Your Name** (print):_____

This is the end of the experiment for you. Please remain seated until the experimenter collects your Decision Sheet.

After the experimenter collects all Decision Sheets, a participant will be asked to draw ping pong balls from an urn to generate a fair lottery. The lottery, as well as all participants' rankings will be entered into a computer after the experiment. The experimenter will inform each participants of his/her allocation slot and respective payoff once it is computed.

IV. Appendix: Experimental instructions - Constrained setting

Instructions - Mechanism B

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 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

- There are 36 participants in this experiment. You are participant #1.
- In this simulation, 36 school slots are available across seven schools. These schools differ in size, geographic location, specialty, and quality of instruction in each specialty. Each school slot is allocated to one participant. There are three slots each at schools A and B, and six slots each at schools C, D, E, F and G.
- **Your payoff** amount depends on the school slot you hold at the end of the experiment + €3 for participating. Payoff amounts are outlined in the following table. These amounts reflect the desirability of the school in terms of location, specialty and quality of instruction.

Slot received at School:	A	B	C	D	E	F	G
Payoff to Participant #1 (in euros)	13	16	9	2	5	11	7

The table is explained as follows:

  - You will be paid €13 if you hold a slot at school A at the end of the experiment.
  - You will be paid €16 if you hold a slot at school B at the end of the experiment.

- You will be paid €9 if you hold a slot at school C at the end of the experiment.
- You will be paid €2 if you hold a slot at school D at the end of the experiment.
- You will be paid €5 if you hold a slot at school E at the end of the experiment.
- You will be paid €11 if you hold a slot at school F at the end of the experiment.
- You will be paid €7 if you hold a slot at school G at the end of the experiment.

***NOTE* different participants might have different payoff tables.** That is, payoff by school might be different for different participants.

- During the experiment, each participant first completes the Decision Sheet by indicating school preferences. The Decision Sheet is the last page of this packet. Note that you need to rank at most three schools in order to indicate your preferences.
- After all participants have completed their Decision Sheets, the experimenter collects the Sheets and starts the allocation process.
- Once the allocations are determined, the experimenter informs each participant whether he/she has been assigned a slot, and if so, which slot and payoff.

Allocation Method

- In this experiment, participants are defined as belonging to the following school districts.
  - Participants #1 – #3 live within the school district of school A,
  - Participants #4 – #6 live within the school district of school B,
  - Participants #7 – #12 live within the school district of school C,
  - Participants #13 – #18 live within the school district of school D,
  - Participants #19 – #24 live within the school district of school E,
  - Participants #25 – #30 live within the school district of school F,
  - Participants #31 – #36 live within the school district of school G.

- In addition, for each school, a separate **priority order** of the students is determined as follows:
  - **Highest Priority Level:** Participants who rank the school as their first choice AND who also live within the school district.
  - **2nd Priority Level:** Participants who rank the school as their first choice BUT who do not live within the school district.
  - **3rd Priority Level:** Participants who rank the school as their second choice AND who also live within the school district.
  - **4th Priority Level:** Participants who rank the school as their second choice BUT who do not live within the school district.
  - **5th Priority Level:** Participants who rank the school as their third choice AND who also live within the school district.
  - **6th Priority Level:** Participants who rank the school as their third choice BUT who do not live within the school district.
- The ties between participants at the same priority level are broken using 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. To determine this fair lottery, a participant will be asked to draw 36 ping pong balls from an urn, one at a time. Each ball has a number on it, corresponding to a participant ID number. The sequence of the draw determines the order in the lottery.
- Therefore, to determine the priority order of a student for a school:
  - The first consideration is how highly the participant ranks the school in his/her Decision Sheet,
  - The second consideration is whether the participant lives within the school district or not, and

- The last consideration is the order in the fair lottery.

- Once the priorities are determined, slots are allocated in four rounds.

Round 1.
a. An application to the first ranked school in the Decision Sheet is sent for each participant.
b. Each school accepts the students with higher priority order until all slots are filled. These students and their assignments are removed from the system. The remaining applications for each respective school are rejected.

Round 2.
a. The rejected applications are sent to his/her second ranked school in the Decision Sheet.
b. If a school still has available slots remaining from Round 1, then it accepts the students with higher priority order until all slots are filled. The remaining applications are rejected.

Round 3.
a. The rejected applications are sent to his/her third ranked school in the Decision Sheet.
b. If a school still has available slots remaining from Round 2, then it accepts the students with higher priority order until all slots are filled. The remaining applications are rejected.

Round 4. A participant whose application was rejected in Round 3 remains unassigned.

- If a participant has been rejected by all schools listed in his/her Decision Sheet, then he/she remains unassigned. The final payoff to a participant will be €3 + the payoff for the obtained slot (in case he/she is assigned a slot).

An Example:
We will 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.

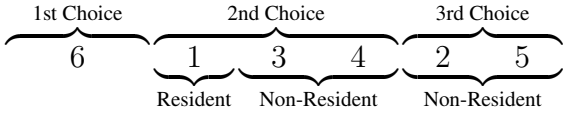
$$1 - 2 - 3 - 4 - 5 - 6$$

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

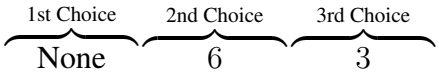
	1st Choice	2nd Choice	3rd Choice
Student 1	Huron	Clair	
Student 2	Huron	Ontario	Clair
Student 3	Ontario	Clair	Erie
Student 4	Huron	Clair	Ontario
Student 5	Ontario	Huron	Clair
Student 6	Clair	Erie	Ontario

Priority: School priorities depend on: (1) how highly the student ranks the school, (2) whether the school is a district school, and (3) the lottery order.

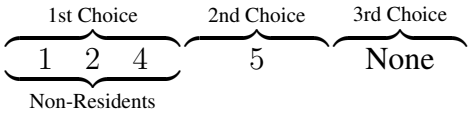
Clair : Student 6 ranks Clair first. Students 1, 3 and 4 rank Clair second; among them, student 1 lives within the Clair school district. Students 2 and 5 rank Clair third. Using the lottery order to break ties, the priority for Clair is 6-1-3-4-2-5.



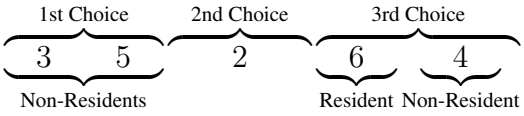
Erie : No student ranks Erie first. Student 6 ranks Erie second. Student 3 ranks Erie third. So, the priority for Erie is 6-3.



Huron : Students 1, 2 and 4 rank Huron first. Student 5 ranks Huron second. Using the lottery order to break ties, the priority for Huron is 1-2-4-5.



Ontario : Students 3 and 5 rank Ontario first. Student 2 ranks Ontario second. Students 4 and 6 rank Ontario third; among them student 6 lives within the Ontario school district. Using the lottery order to break ties, the priority for Ontario is 3-5-2-6-4.



Allocation: This allocation method consists of the following rounds.

Round 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.

- School Clair accepts Student 6.
- School Huron accepts Student 1 and rejects Students 2,4.
- School Ontario accepts Student 3 and rejects Student 5.

Applicants		School		Accept	Reject		Slot 1	Slot 2
6	$\longrightarrow$	Clair	$\longrightarrow$	6		$\longrightarrow$	$\boxed{6}$	$\square$
	$\longrightarrow$	Erie	$\longrightarrow$			$\longrightarrow$	$\square$	$\square$
1, 2, 4	$\longrightarrow$	Huron	$\longrightarrow$	1	2, 4	$\longrightarrow$	$\boxed{1}$	—
3, 5	$\longrightarrow$	Ontario	$\longrightarrow$	3	5	$\longrightarrow$	$\boxed{3}$	—

Accepted students are removed from the subsequent process.

Round 2 : Each student who is rejected in Round 1 then applies to his/her second choice: Student 2 applies to Ontario, student 4 applies to Clair, and student 5 applies to Huron.

- No slot is left at Ontario, so it rejects student 2.
- Clair accepts student 4 for its last slot.
- No slot is left at Huron, so it rejects student 5.

Applicants		School		Accept	Reject		Slot 1	Slot 2
4	$\longrightarrow$	Clair	$\longrightarrow$	4		$\longrightarrow$	$\boxed{6}$	$\boxed{4}$
	$\longrightarrow$	Erie	$\longrightarrow$			$\longrightarrow$	$\square$	$\square$
5	$\longrightarrow$	Huron	$\longrightarrow$		5	$\longrightarrow$	$\boxed{1}$	—
2	$\longrightarrow$	Ontario	$\longrightarrow$		2	$\longrightarrow$	$\boxed{3}$	—

Round 3 : Each student who is rejected in Rounds 1-2 applies to his/her third choice: Students 2 and 5 apply to Clair.

- No slot is left at Clair, so it rejects students 2 and 5.

Applicants		School		Accept	Reject		Slot 1	Slot 2
2, 5	$\longrightarrow$	Clair	$\longrightarrow$		2, 5	$\longrightarrow$	$\boxed{6}$	$\boxed{4}$
	$\longrightarrow$	Erie	$\longrightarrow$			$\longrightarrow$	$\square$	$\square$
	$\longrightarrow$	Huron	$\longrightarrow$			$\longrightarrow$	$\boxed{1}$	—
	$\longrightarrow$	Ontario	$\longrightarrow$			$\longrightarrow$	$\boxed{3}$	—

Round 4 : Students 2 and 5 were rejected by Clair. Since the School Rankings of students 2 and 5 have been exhausted these students remain unassigned.

Based on this method, the final allocations are:

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

You will have 15 minutes to go over the instructions at your own pace, and make your decisions. Feel free to earn as much cash as you can. Are there any questions?

Decision Sheet - Mechanism B

- Recall: You are participant #1 and you live within the school district of School A .
- Recall: **Your payoff** amount depends on the school slot you hold at the end of the experiment. Payoff amounts are outlined in the following table.

School:	A	B	C	D	E	F	G
Payoff in euros	13	16	9	2	5	11	7

You will be paid € 13 if you hold a slot of School A at the end of the experiment.
You will be paid € 16 if you hold a slot of School B at the end of the experiment.
You will be paid € 9 if you hold a slot of School C at the end of the experiment.
You will be paid € 2 if you hold a slot of School D at the end of the experiment.
You will be paid € 5 if you hold a slot of School E at the end of the experiment.
You will be paid € 11 if you hold a slot of School F at the end of the experiment.
You will be paid € 7 if you hold a slot of School G at the end of the experiment.

Please write down a ranking of up to 3 schools.

1st choice	2nd choice	3rd choice

Your I.D : #1 **Your Name** (print):_____

This is the end of the experiment for you. Please remain seated until the experimenter collects your Decision Sheet.

After the experimenter collects all Decision Sheets, a participant will be asked to draw ping pong balls from an urn to generate a fair lottery. The lottery, as well as all participants' rankings will be entered into a computer after the experiment. The experimenter will inform each participants of his/her allocation slot and respective payoff once it is computed.

Instructions - Mechanism G

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Allocation Method

- In this experiment, participants are defined as belonging to the following school districts.
  - Participants #1 – #3 live within the school district of school A,
  - Participants #4 – #6 live within the school district of school B,
  - Participants #7 – #12 live within the school district of school C,
  - Participants #13 – #18 live within the school district of school D,
  - Participants #19 – #24 live within the school district of school E,
  - Participants #25 – #30 live within the school district of school F,
  - Participants #31 – #36 live within the school district of school G.
- A priority order is determined for each school. Each participant is assigned a slot at the **best possible** school reported in his/her Decision Sheet that is consistent with the priority order below.
- The priority order for each school is separately determined as follows:
  - **High Priority Level:** Participants who live within the school district.

    Since the number of High priority participants at each school is equal to the school capacity, each High priority participant is guaranteed an assignment that is at least as good as his/her district school based on the ranking indicated in his/her Decision Sheet.
  - **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. To determine this fair

lottery, a participant will be asked to draw 36 ping pong balls from an urn, one at a time. Each ball has a number on it, corresponding to a participant ID number. The sequence of the draw determines the order in the lottery.

- Once the priorities are determined, the allocation of school slots is obtained as follows:
  - An application to the first ranked school in the Decision Sheet 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.
  - Whenever an applicant is rejected at a school, his application is sent to the next highest school on his Decision Sheet.
  - 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 finalized 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.
- If a participant has been rejected by all schools listed in his/her Decision Sheet, then he/she remains unassigned. The final payoff to a participant will be €3 + the payoff for the obtained slot (in case he/she is assigned a slot).

An Example:

We will 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
Student 1	Huron	Clair	
Student 2	Huron	Ontario	Clair
Student 3	Ontario	Clair	Erie
Student 4	Huron	Clair	Ontario
Student 5	Ontario	Huron	Clair
Student 6	Clair	Erie	Ontario

Priority : 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

The 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	$\longrightarrow$	Clair	$\longrightarrow$	$\boxed{6}\square$	
	$\longrightarrow$	Erie	$\longrightarrow$	$\square\square$	
1, 2, 4	$\longrightarrow$	Huron	$\longrightarrow$	$\boxed{1}$ –	2, 4
3, 5	$\longrightarrow$	Ontario	$\longrightarrow$	$\boxed{3}$ –	5

Step 2 : Each student rejected in Step 1 applies to his/her next 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
$\boxed{6}\,\square$	4	$\longrightarrow$	Clair	$\longrightarrow$	$\boxed{6}\,\boxed{4}$	
$\square\,\square$		$\longrightarrow$	Erie	$\longrightarrow$	$\square\,\square$	
$\boxed{1}$ –	5	$\longrightarrow$	Huron	$\longrightarrow$	$\boxed{5}$ –	1
$\boxed{3}$ –	2	$\longrightarrow$	Ontario	$\longrightarrow$	$\boxed{2}$ –	3

Step 3 : Each student rejected in Step 2 applies to his/her next 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
$\boxed{6}\,\boxed{4}$	1, 3	$\longrightarrow$	Clair	$\longrightarrow$	$\boxed{1}\,\boxed{3}$	4, 6
$\square\,\square$		$\longrightarrow$	Erie	$\longrightarrow$	$\square\,\square$	
$\boxed{5}$ –		$\longrightarrow$	Huron	$\longrightarrow$	$\boxed{5}$ –	
$\boxed{2}$ –		$\longrightarrow$	Ontario	$\longrightarrow$	$\boxed{2}$ –	

Step 4 : Each student rejected in Step 3 applies to his/her next 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
$\boxed{1}\,\boxed{3}$		$\longrightarrow$	Clair	$\longrightarrow$	$\boxed{1}\,\boxed{3}$	
$\square\,\square$	6	$\longrightarrow$	Erie	$\longrightarrow$	$\boxed{6}\,\square$	
$\boxed{5}$ –		$\longrightarrow$	Huron	$\longrightarrow$	$\boxed{5}$ –	
$\boxed{2}$ –	4	$\longrightarrow$	Ontario	$\longrightarrow$	$\boxed{2}$ –	4

Student 4 was rejected by Ontario. Since the School Ranking of student 4 has been exhausted this student remains unassigned. Based on this method, the final allocations are:

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

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Instructions - Mechanism T

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Allocation Method

- In this experiment, participants are defined as belonging to the following school districts.
  - Participants #1 – #3 live within the school district of school A,
  - Participants #4 – #6 live within the school district of school B,
  - Participants #7 – #12 live within the school district of school C,
  - Participants #13 – #18 live within the school district of school D,
  - Participants #19 – #24 live within the school district of school E,
  - Participants #25 – #30 live within the school district of school F,
  - Participants #31 – #36 live within the school district of school G.
- Each participant is first tentatively assigned to the school within his/her respective district. Next, Decision Sheet rankings are used to determine mutually beneficial exchanges between two or more participants. The order in which these exchanges are considered is determined by 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. To determine this fair lottery, a participant will be asked to draw 36 ping pong balls from an urn, one at a time. Each ball has a number on it, corresponding to a participant ID number. The sequence of the draw determines the order in the lottery.
- The specific allocation process is explained below.
  - Initially all slots are available for allocation.
  - All participants are ordered in a queue based on the order in the lottery.
  - Next, an application to the highest ranked school in the Decision Sheet is submitted for the participant at the top of the queue.

* If the application is submitted to his district school, then his/her tentative assignment is finalized (thus he/she is assigned a slot at his district school). The participant and his/her assignment are removed from subsequent allocations. The process continues with the next participant in line.
* If the application is submitted to another school, say school S, then the first participant in the queue who tentatively holds a slot at School S 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 participant at the top of the queue.
* If the application is submitted to his district school, then his/her tentative assignment is finalized. The process continues with the next participant in line.
* If the application is submitted to another school, say school S, then the first participant in the queue who tentatively holds a slot at school S is moved to the top of the queue directly in front of the requester. This way, each participant is guaranteed an assignment which is at least as good as his/her district school based on the preferences indicated in his/her Decision Sheet.

– A mutually-beneficial exchange is obtained when a cycle of applications are made in sequence, which benefits all affected participants, 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 participants as well as their assignments are removed from subsequent allocations.

– The process continues until there is no longer a mutually-beneficial exchange or a student submitting an application.

- If a participant has been rejected by all schools listed in his/her Decision Sheet, then he/she remains unassigned. The final payoff to a participant will be €3 + the payoff for the obtained slot (in case he/she is assigned a slot).

An Example:

We will 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
Student 1	Huron	Clair	
Student 2	Huron	Ontario	Clair
Student 3	Ontario	Clair	Erie
Student 4	Huron	Clair	Ontario
Student 5	Ontario	Huron	Clair
Student 6	Clair	Erie	Ontario

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 top 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 top 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 top 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 top 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 mutually beneficial 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 top choice between the two schools with remaining slots. Since student 2 tentatively holds a slot at Clair, her tentative assignment is finalized. 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 finalized. 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, but since Erie is not listed in student 4's Decision Sheet, she remains unassigned.

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

Student	1	2	3	4	5	6
School	Huron	Clair	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 his 1st choice Huron, which is tentatively assigned to 5.	5 comes to the top. 1-2-3-4-**5**-6
Step 2	5-1-2-3-4-6	Clair Clair Erie Erie Huron Ontario	5 applies to his 1st choice Ontario which is tentatively assigned to 6.	6 comes to the top. 5-1-2-3-4-**6**
Step 3	6-5-1-2-3-4	Clair Clair Erie Erie Huron Ontario	6 applies to her 1st choice Clair, which is tentatively assigned to 1 and 2.	1 comes to the top. 6-5-**1**-2-3-4
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 1st 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 she is a resident in Erie.
Step 7	4	Erie	4 does not apply to any other school since none of the schools in her list has a vacant slot.	4 remains without a slot, and Erie remains with a vacant seat.