Singapore's Primary 1 Registration: Redesigning the School Choice Mechanism

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Abstract

A prominent issue in school choice is the design of a student assignment mechanism. Prior mechanism design approaches to resolving school choice problems have been met with much implementational success; a notable example is the reform of the Boston Mechanism in Boston Public Schools in 2005. This paper seeks to build on previous literature on school choice and present an altered DA (deferred acceptance) algorithm to suit the Singapore context. I show that this altered mechanism provides a practical solution to some of the critical issues faced in the current Singapore P1 Registration allocation system, resulting in a (i) strategyproof, (ii) fair, and (iii) nonwasteful algorithm that is preferable to the existing one.

1 Introduction

Every year, over 40,000 Singaporean prospective Primary 1 students and their parents undergo the undeniably stressful Singapore Primary 1 Registration Exercise. The current exercise has been in place since the 1980s; over time, more and more rules have been added to its structure, resulting in an increasing convoluted and long-drawn system. This paper seeks to propose a centralised school choice system that incorporates parent preferences and a strategy-proof mechanism that will not only provide a more stable allocation of students to schools, but also significantly reduce the time and resources spent on the registration exercise.

Examples of successful school allocation mechanism reforms proliferate; in 2005, the Boston School Committee voted to reform the existing Boston student assignment mechanism with a deferred-algorithm mechanism based on the Gale-Shapley algorithm that is strategy-proof. Two algorithms were proposed: the deferred acceptance (DA) mechanism as well as a top-trading cycles mechanism. This paper seeks to apply the findings of the Boston school choice mechanism to the Singaporean context, and modify the proposed DA algorithm to suit the

Singapore Primary 1 (Grade 1) registration exercise.

The current Singapore mechanism, like the Boston mechanism, is a priority matching mechanism. [1] However, unlike the Boston mechanism, where students submit a list of preferences and are matched to schools according to a strict priority order, the Singapore mechanism is carried out through separate demarcated phases, and the onus is on the parents to submit an application for their child in their desired school and corresponding phase(s). Furthermore, in the Boston mechanism, all students undergo the first step, as all applicants have a first choice by default. Contrastingly, under the Singapore mechanism, not all students qualify for all phases, and only students that submit applications to a specific school will be considered for the phase in question.

Idiosyncrasies of the Singapore Mechanism

Taking into consideration the complexities of the Singapore mechanism as described above, it would be instructive to outline a few of its unique features:

1. *Multi-phase Eligibility.* One consequence of the phased system specified by the Ministry is that a student may be eligible for multiple slots under different priorities in any one school.

2. *Minimum Quotas.* In 2014, a rule was introduced requiring all primary schools to set aside 40 places for children in the later stages. The 40 places will be split equally between children registering in Phases 2B and 2C. [1]

Given the idiosyncrasies outlined above, a simple student-proposing deferred acceptance algorithm or top-trading cycle will not be sufficient to account for the priority-orders, multi-phase eligibility, and the quota capacities of the Singapore school choice system whilst satisfying other important desiderata. This paper therefore proposes an alternative mechanism, and examines its suitability for application in Singapore's P1 registration process.

Desiderata

In the process of designing a mechanism for the Singapore context, several desiderata will be kept in mind:

1. *Timeliness.* The current system is a long-drawn process that takes place annually from July - November, and each school handles its own balloting and admissions despite standardised rules specified by the Ministry. Furthermore, parents are required to take time off work to register their child in person at each individual school (with the exception of a few phases), resulting in significant time wastage. With the introduction of a centralised

[1] It is important to note that these are *soft* quotas. If, for instance, only 35 students applied for Phase 2B and 2C for a specific school s, there would be no need to force 5 more students to attend school s in order to fulfill the quota.

matching mechanism, parents will only need to submit their preferences once, eliminating the need for in-person registration. This will significantly reduce the time needed to be set aside for the registration exercise and save a lot of time for parents, schools, and also the Ministry.

2. *Transparency.* The complexity of the current Singapore mechanism has made the process opaque and sometimes indecipherable to the average Singaporean parent. In designing the mechanism, an important consideration would be the transparency of its algorithmic description and how comprehensible it is to the average Singaporean parent.

3. *Strategyproof-ness.* A mechanism is considered strategyproof if no student ever has the incentive to misreport her preferences, no matter what the other students report. The current structure of the Singapore mechanism gives parents the strategic incentive to misrepresent their true preferences. As with the Boston mechanism, it can be costly to list a first-choice that you do not succeed in getting because once other students are assigned to their places, they cannot be displaced even by a student with a higher priority. [1] Unsurprisingly, there are entire websites dedicated to strategising the registration exercise - one such website, KiasuParents.com, [7] even goes so far as to compute oversubscription risks for each school. Compounded with the lack of transparency, this predisposition for "gaming" the system heavily disadvantages families that do not strategise, or that strategise inadequately.

4. *Fairness.* Fairness (also called "stability" or "no justified envy") requires that there is no student u that prefers school s to her assigned school when some other student with lower priority is assigned to s. Inadequate strategising inherent to the Singapore mechanism has rendered fairness unlikely; it is very common for students to apply to a less desired school in order to avoid having to ballot for space in their more preferred school, only to eventually envy another student that gets in to their preferred school with a lower priority.

5. *Nonwastefulness.* A matching is considered nonwasteful if for any school s that has empty seats, no student u would prefer school s to her existing assignment. Given that only a very small handful of school have remaining empty seats at the end of the exercise (and these empty seats are usually then filled up by non-Singaporeans), it would not be unreasonable to state that the current Singapore mechanism is nonwasteful. There is the possibility, however, of parents strategising inadequately and applying to a less preferred school even if their preferred school has remaining capacity. Parents could misjudge the demand for a school that will have empty seats at the end of the registration cycle, and apply to a less preferred school to be "safe".

Another concern that arises with the Singapore mechanism is its current priority hierarchy: the Singaporean public has been embroiled in much debate over whether enrolment criteria should be altered.[10] This paper only seeks to propose a student assignment mechanism under the current priority hierarchy specified by the Ministry of Education; it does not seek to assert normative judgments on the existing priority system.[2] For instance, one question commonly raised by the public asks whether local schools should give priority to Primary 1 students who live nearby, despite indications that this perpetuates existing economic inequality and implicitly prioritises students from wealthy backgrounds. Due to the complications and vast scope of such an examination, this paper will refrain from attempting to resolve such overarching ethical questions. Instead, I focus on designing a mechanism that is simultaneously strategy-proof, fair, and nonwasteful without altering the current hierarchy of priorities specified by the Ministry.

2 Related Literature

School choice is a well-trodden area of research; the Boston mechanism in particular has been studied extensively since Abdulkadiroglu and Sönmez's [3] seminal paper on school choice mechanisms. Since then, many variations on the standard Gale-Shapley deferred acceptance algorithm have been explored in the context of school matching. Adjustments for multi-phase eligibility, and accomodations for minimum quotas certainly aren't untrodden ground: even the original Boston Public Schools (BPS) implementation of DA had a walk-zone priority feature that bears resemblance to the multi-phase eligibility I will accommodate for in our Singapore model. Interestingly, the decision of how to deal with the "multi-phase eligibility" of students that qualified for both the reserved walk-zone priority slots (50% of total slots) as well as the remaining open slots was viewed as an inconsequential detail and left to BPS software support. Research on how the precedence order, i.e. the order in which these different types of seats were filled by students, later emerged in Dur et al.'s [4] paper on the demise of walk zones in Boston.

Minimum quotas have been a somewhat recent extension to standard matching models, and the theory of matching has been more extensively developed for markets with maximum quotas. Most research into maximum quotas has been in context of affirmative action policies; in their seminal paper, Abdulkadiroglu and Sönmez extend their analysis of the DA algorithm to accommodate a simple affirmative action policy with type-specific maximum quotas. More recently, Kojima [8] investigates the welfare effects of affirmative action policies with quotas for majority students. Hafalir et al. [6] then offer a different interpretation of affirmative action policies based on minority reserves, where

[2]Granted, strategyproofness, fairness, and nonwastefulness can be considered normative axioms as well. However, ethical questions that arise from the determination of priority hierarchy require other (arguably more contentious) normative criteria; thus, I will treat priority hierarchy as requiring a different class of normative judgment, and allow school priorities to be exogenously subscribed in accordance to the current priority system.

schools give higher priority to minority studensts up to the point that the minorities fill the reserves. Westkamp [11] then studies the German university admissions system in a "matching with complex constraints" problem, accommodating transferable quotas on different subpopulations.

This paper bears closest comparison to Fragiadakis et al. [5], who introduce two new classes of strategyproof mechanisms that allow for minimum quotas as an explicit input. Their first new mechanism, extended-seat deferred acceptance (ESDA), divides seats into two classes: "regular" seats equal to its minimum quota, and "extended" seats equal to the difference between the minimum and maximum quota. According to their individual preferences, students first apply to "regular" seats, and then to the "extended" seats.

The assignment procedure proposed in this paper differs from the ESDA in that it does not deal with *hard* minimum quotas; that is, there is no need to fill up all the "regular" seats. Therefore, instead of filling "regular" seats first, the proposed algorithm fills up all the "extended" seats first, treating the minimum quota as an "inverse" maximum quota. I present a modified DA algorithm that combines both multi-phased eligibility and *soft* minimum quotas, and that is simultaneously strategyproof, fair, and nonwasteful. To the best of my knowledge, this paper is the first study of the Singapore P1 Registration Exercise from a mechanism design approach. The proposed alternative holds practical relevance for the reform of the current Singapore mechanism; therefore, it is the hope that this study will spark a reexamination of the existing assignment system and encourage consideration of a new assignment mechanism.

3 The Current Singapore Mechanism

In Singapore, students are allocated seats at local schools through a complex process laid out by the Ministry of Education. The details of the order of priority are specified on the Ministry's website, and comprehensive videos have been released to aid parents in understanding the registration process. [9] The exercise is conducted in consecutive phases, with buffer time of about a week between each phase for parents to hear back about their application result and to decide whether they need to submit an application for the next phase. The chronology of the phases is summarised by the diagram on the following page.

For phases that are oversubscribed (i.e. the number of applications to a school exceeds the number of vacancies available in that particular phase), balloting will occur. Within any oversubscribed phase (barring Phase 3), Singaporean Citizens are given absolute priority over Singapore Permanent Residents, before home-school distance is considered. A random lottery number is then used to break the ties in each category and determine a strict priority order, as with the Boston Mechanism. [2] Consider the following example for illustration:

Home - School Distance	Singapore Citizen (SC)	Permanent Resident (PR)
<1 km	38	2
Between 1 km and 2 km	10	1
>2km	8	1
Total	56	5

Figure 1: Example of a school s that has 50 vacancies in a specific phase and 60 children applying

In the example above, the total number of SC applications exceeds the number of vacancies. The vacancies are allocated based on home-school distance in the following order of priority: (1) within 1 km, (2) between 1 km and 2 km and (3) outside 2 km. The 38 SC children living within 1 km from the school are admitted first, followed by the 10 SC children living between 1 km and 2 km from the school. After the 48 vacancies are taken up, the remaining 2 vacancies are balloted by random lottery amongst the 8 SC children living more than 2 km from the school.

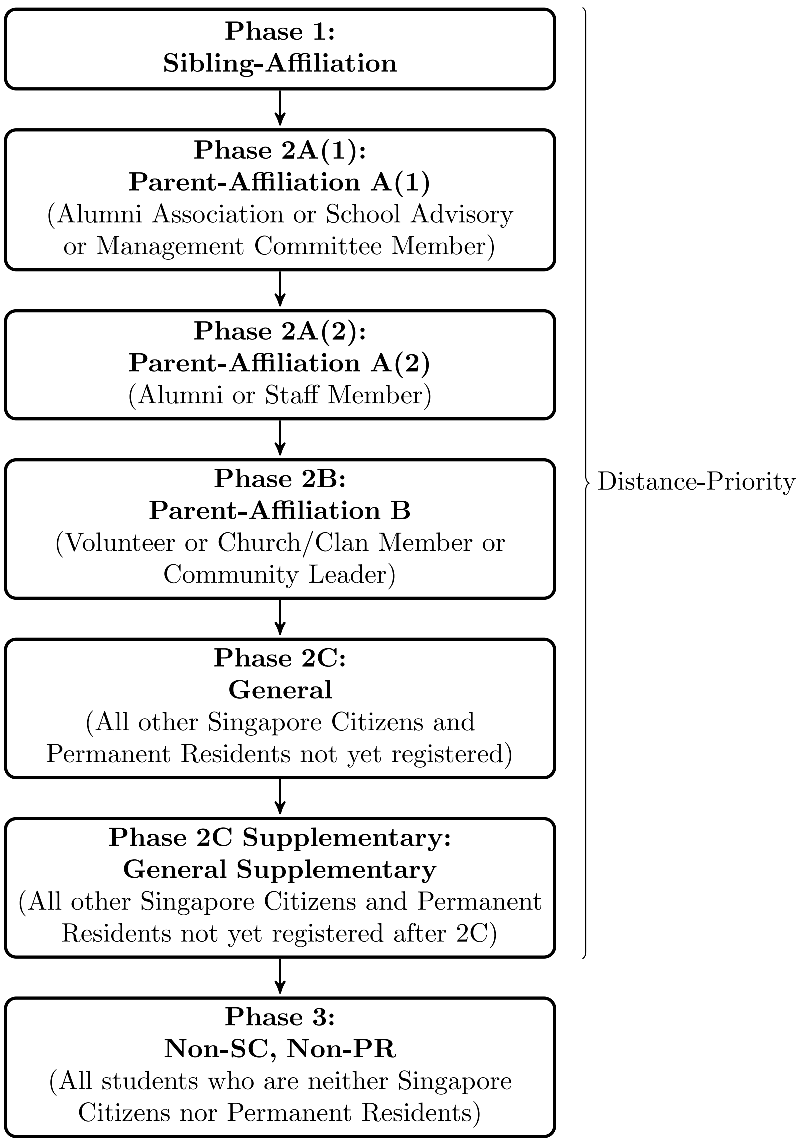

Figure 2: Registration Phases and Procedures

The Singapore mechanism assigns students as follows:

Step 1. – For each school, consider the students that have applied to it through the *first* phase and assign places to these students in priority order until either no places remain (setting aside reserved seats for Phase 2B and 2C) or all students have been placed.

Step k. – For each school, consider the students that have applied to it through the kth phase and assign places to these students in priority order until either no places remain (setting aside reserved seats for Phase 2B and 2C, if these phases have not already occurred) or all students have been placed.

The procedure terminates when all students are assigned a seat, or when all places at schools are allocated. Admission is not guaranteed for Phase 3 applicants as there are limited vacancies remaining for non-SC or non-PR children.

4 The Model

There is a finite set U of students and a finite set S of schools. Each student u has a strict preference relation P_u over S. For each school s, there are two types of spaces students can qualify for: *Phase A* (encompassing Phases 1 through to 2A(2)), and *Phase B* (Phase 2B onwards).[3] The demarcation of these phases is to account for the minimum quota of 40 students that must be reserved for *Phase B*.[4] In practice, there would be three types of spaces – Phase 2B and 2C would be considered two separate categories, each with 20 reserved places – but for simplicity's sake, our model will only have two categories. This will be sufficient for our illustrative purposes.

For each school $s \in S$, we use S_s to represent the total capacity of the school. A **matching** $\mu : U \to S$ is a function which assigns a school to each student such that no school s is assigned to more than S_s students. Let μ_u denote the assignment of student u, and let μ_s denote the set of students assigned to school s.

Define $I_{k,s}$ as the set of students consisting of the applicants applying to school s in round k that qualify for *Phase A*, and $J_{k,s}$ as the set of students consisting of the applicants applying to school s in round k that qualify for *Phase B*. For a school $s \in S$, *Phase A* slots have a linear priority order $\pi_{i,s}$ over students in U, and *Phase B* slots have a linear priority order $\pi_{j,s}$ over students in U.

Given a school $s \in S$, a list of priority orders $\pi_{i,s}$, the maximum *Phase A* capacity $S_s - 40$, and a set of students $I_{k,s} \subseteq U$, the **choice of school** s **from the set of students** $I_{k,s}$, denoted by $C_s(I_{k,s}, S_s - 40)$, is obtained as follows: the top $S_s - 40$ students in $I_{k,s}$ are tentatively accepted under order $\pi_{i,s}$. Similarly, given a list of priority orders $\pi_{j,s}$, an exogenously specified number of students x, and a set of students $J_{k,s} \subseteq U$, the **choice of school** s **from the set of students** $J_{k,s}$, denoted by $C_s(J_{k,s}, x)$, is obtained as follows: the top x students in $J_{k,s}$ are tentatively accepted under order $\pi_{j,s}$.

[3]For the sake of simplicity, we omit Phase 3 from our considerations as non-SC and non-PR children are not guaranteed admission.

[4]All students are eligible for Phase B.

Based on preferences, priorities and school capacities, student assignments are determined with the following algorithm:

Step 1. – Each student u applies to her top choice of school. Each school s considers the set $I_{1,s}$ of students consisting of the applicants qualifying for *Phase A* and the set $J_{1,s}$ of students consisting of the applicants qualifying for *Phase B*. Note that it is possible for a student to be in both $I_{1,s}$ and $J_{1,s}$. Consider the two following cases:

> *Case 1: Phase A is oversubscribed*, meaning that $I_{1,s} > S_s - 40$. Each school s tentatively holds the applicants in $C_s(I_{1,s}, S_s{-}40)$ and $C_s(J_{1,s}, 40)$ and rejects the rest. Note that applicants rejected from $I_{1,s}$ may be eligible to be tentatively accepted within $C_s(J_{2,s}, 40)$.
>
> *Case 2: Phase A is undersubscribed*, meaning $I_{1,s} < S_s - 40$. Each school s tentatively holds all qualifying applicants $I_{1,s}$ and $C_s(J_{1,s}, S_s - I_{1,s})$ and rejects the rest.

If an applicant can be tentatively accepted in both $C_s(I_{1,s}, S_s{-}40)$ and $C_s(J_{1,s}, x)$, she is included in $C_s(I_{1,s}, S_s - 40)$; in other words, she is considered to be accepted under *Phase A* and excluded from $C_s(J_{1,s}, 40)$.

Step k. – Each student u rejected in step $k-1$ applies to her most preferred school that has not yet rejected her. If a student has been rejected in step $k-1$ after being tentatively accepted in *Phase A* during some previous step (i.e. $s \in C_s(I_{a,s}) \mid a < k-1$), consider their eligibility for *Phase B* at the same school before proposing to their next most preferred school. Each school s considers the set $I_{k,s}$ consisting of the new applicants to s and the students held by s at the end of step $k-1$ under *Phase A*, and the set $J_{k,s}$ consisting of the new applicants to s and the students held by s at the end of step $k-1$ under *Phase B*. Note that it is possible for a student to be in both $I_{k,s}$ and $J_{k,s}$. Consider the two following cases:

> *Case 1: Phase A is oversubscribed*, meaning that $I_{k,s} > S_s - 40$. Each school s tentatively holds the applicants in $C_s(I_{k,s}, S_s{-}40)$ and $C_s(J_{k,s}, 40)$ and rejects the rest. Note that applicants rejected from $I_{k,s}$ may be eligible to be tentatively accepted within $C_s(J_{k+1,s}, 40)$.
>
> *Case 2: Phase A is undersubscribed*, meaning $I_{k,s} < S_s - 40$. Each school s tentatively holds all qualifying applicants $I_{k,s}$ and $C_s(J_{k,s}, S_s - I_{k,s})$ and rejects the rest.

The procedure terminates when all students are assigned a seat, or when all places at schools are allocated.

5 Evaluation of the Two Mechanisms

Unlike the Boston mechanism, the current Singapore system does not collect ranked preferences from students, so preferences are implied through the students' actual applications to schools. Furthermore, given the distorting incentives under Singapore's current school choice mechanism, the obtainable data that rely on implied preferences cannot be used to assess the effectiveness of the mechanism. As such, two situations that illustrate the differences between the current Singapore mechanism and the new altered DA mechanism will be presented. In doing so, this paper hopes to highlight the preferability of the new system as measured against the desiderata established in the introduction.

Example 1: *The Current Singapore Mechanism.* There are four schools $S = \{h, l, m, n\}$. Each school has one available space under *Phase A* and one available under *Phase B.* The following students qualify for *Phase A* at each school: $\pi_{i,h} = u_1 \succ u_2$, $\pi_{i,l} = u_3$, $\pi_{i,m} = u_5 \succ u_6$, $\pi_{i,n} = u_8 \succ u_7$. The priority order for students in *Phase B* are as follows:

$$\begin{aligned}\pi_{j,h} &= u_1 \succ u_8 \succ u_3 \succ u_4 \succ u_5 \succ u_6 \succ u_7 \succ u_2\\ \pi_{j,l} &= u_7 \succ u_8 \succ u_3 \succ u_4 \succ u_1 \succ u_5 \succ u_6 \succ u_2\\ \pi_{j,m} &= u_5 \succ u_1 \succ u_3 \succ u_4 \succ u_7 \succ u_2 \succ u_8 \succ u_6\\ \pi_{j,l} &= u_4 \succ u_3 \succ u_6 \succ u_2 \succ u_8 \succ u_5 \succ u_7 \succ u_1\end{aligned}$$

The preference profile of the students is:

P_{u_1}	P_{u_2}	P_{u_3}	P_{u_4}	P_{u_5}	P_{u_6}	P_{u_7}	P_{u_8}
h	h	l	l	m	m	n	h
l	l	h	h	n	h	h	l
m	m	m	m	h	l	l	n
n	n	n	n	l	n	m	m

Consider *Phase A* applications. Students u_1, u_2, u_3, u_5, u_6, and u_7 all apply to their top choice of school as they each qualify for *Phase A* in their most preferred schools. u_4 does not qualify for *Phase A* at any school. u_8 most prefers school h but decides to apply to school n under *Phase A*, because she fears she will not be able to get into h under *Phase B.*

The outcome of *Phase A* in this case is:

$$\mu_i = \begin{pmatrix} u_1 & u_3 & u_5 & u_8 \\ h & l & m & n \end{pmatrix}$$

In the next phase, the rest of the students that have yet to be assigned a school apply to their next preferred choice. If they are rejected, they apply to the next preferred school that has available spaces. The final outcome of the current Singapore mechanism for this situation is as follows:

$$\mu = \begin{pmatrix} u_1 & u_2 & u_3 & u_4 & u_5 & u_6 & u_7 & u_8 \\ h & l & l & h & m & n & m & n \end{pmatrix}$$

Notice how this mechanism is not strategy-proof. If u_7 had refrained from entering *Phase A* and applied to n in *Phase B* instead, she would have been accepted into her top choice of school. Furthermore, this example illustrates how the Singapore mechanism is not devoid of justified-envy. For example, u_6 justifiably envies u_2 because u_2 has a preferred match of l even though she has lower priority in *Phase B* than u_6.

Example 2: *The Altered DA Mechanism.* Let us consider the same set of schools and student preferences. There are four schools $S = \{h, l, m, n\}$. Each school has one available space under *Phase A* and one reserved space under *Phase B.* The priority orders over the set of students I_s are as follows: $\pi_{i,h} = u_1 \succ u_2$, $\pi_{i,l} = u_3$, $\pi_{i,m} = u_5 \succ u_6$, $\pi_{i,n} = u_8 \succ u_7$. The priority orders over the set of students J_s are as follows:

$$\begin{aligned} \pi_{j,h} &= u_1 \succ u_8 \succ u_3 \succ u_4 \succ u_5 \succ u_6 \succ u_7 \succ u_2 \\ \pi_{j,l} &= u_7 \succ u_8 \succ u_3 \succ u_4 \succ u_1 \succ u_5 \succ u_6 \succ u_2 \\ \pi_{j,m} &= u_5 \succ u_1 \succ u_3 \succ u_4 \succ u_7 \succ u_2 \succ u_8 \succ u_6 \\ \pi_{j,l} &= u_4 \succ u_3 \succ u_6 \succ u_2 \succ u_8 \succ u_5 \succ u_7 \succ u_1 \end{aligned}$$

The preference profile of the students is:

P_{u_1}	P_{u_2}	P_{u_3}	P_{u_4}	P_{u_5}	P_{u_6}	P_{u_7}	P_{u_8}
h	h	l	l	m	m	n	h
l	l	h	h	n	h	h	l
m	m	m	m	h	l	l	n
n	n	n	n	l	n	m	m

All students submit their ranked list of preferences truthfully. The final outcome of the altered DA mechanism for this situation is as follows:

$$\mu = \begin{pmatrix} u_1 & u_2 & u_3 & u_4 & u_5 & u_6 & u_7 & u_8 \\ h & m & l & l & m & n & n & h \end{pmatrix}$$

One consideration to be made is whether the new mechanism actually benefits the very people it is trying to help. Observe that six students are assigned to their most-preferred school under the new altered DA, as opposed to three students in the Singapore mechanism. Notice, furthermore, that every student is either equally well off or better off under the DA mechanism as compared to the Singapore mechanism, with the exception of u_2, who gets her third choice as opposed to her second choice. However, recall from the previous example that u_2 is the object of justified envy, so it was the failings of the previous system that had allowed u_2 to receive a better school assignment than she should have gotten, given her position in the priority orders.

The new model in question results in a stable matching. Note that the algorithm must end in a finite number of rounds. Suppose that a student u is matched to a school s, but u prefers s'. At some point within the algorithm, u would have proposed to s' under *Phase B* (or both *Phase A* and *Phase B*), and been rejected by the school. Note that if that student has been rejected, it must be because that the school has been filled to its capacity with higher-ranked students in all of the phases u qualifies for. Since the ranking of students assigned to each phase in a school only improves as the algorithm continues, at the end of the algorithm, u must be lower ranked than every student assigned to s, and hence cannot form a blocking pair with any of these students.[5] Therefore, the algorithm is fair. Fairness in arguably an important characteristic to have, because it prevents feelings of discontent from arising amongst the parents. Discussion forums about the registration exercise are often inundated with disgruntled parents, so having a system that is fair would relieve some of the tension as well as lift some burden off of the MoE to respond to parent queries.

Furthermore, because the algorithm starts by considering students' highest ranked school, and only rejects a student if it is filled to its capacity with higher-ranked students, and each student has an opportunity to be considered for *Phase B* even if they have been rejected from *Phase A*, the algorithm is non-wasteful. For any school that has empty seats, no student u would prefer s to her existing assigned school. [6]

Another major advantage that arises from this model is that it is strategy-proof, similar to the original DA algorithm. Fixing all the priority hierarchies of schools and preferences of all but one student u, the best option for u is to make a truthful report of her preferences. Suppose that the proposed DA algorithm will result in matching u to school s. Note that the matching can only be affected by the preferences that u lists before s. Misrepresenting her preferences by omitting some of her preferred schools or by listing them in a different order will not result in a change to her matching to school s. Listing a less preferred school s' above school s could possibly result in a less optimal match, as it is possible that u would be matched to s' instead of s. This would not be preferable for u. This analysis holds whether or not u is being considered under *Phase A* or *Phase B*. Strategyproofness is certainly a compelling argument for moving to a

[5]This is given the condition that a student admitted under *Phase A* cannot form a blocking pair with someone who would have to be admitted through *Phase B*, due to the reservation of slots.

[6]In the presence of minimum quotas, it has been established that it is not necessarily the case that matchings are simultaneously fair and nonwasteful. [5] This boiled down to the nature of *hard* minimum quotas, as a student u might have to be assigned to a school s' with minimum quotas despite the possibility of being accepted into a more preferred school s. As a result, u could justifiably envy a student who has been accepted at school s despite being lower ranked than u. However, the algorithm proposed in this paper does not face this issue, because the minimum quotas are *soft* quotas.

new algorithm. The acute need to strategise in the current mechanism provides an unfair advantage to families that have the resources and time to conduct the necessary research. Enabling families to to list their true choices of schools without jeopardizing their chances of being assigned to any school would reduce a lot of stress and time spent on the exercise. It would also increase clarity, allowing for straightforward advice to be provided to parents regarding how to rank schools.

6 Conclusion

Singapore's Primary 1 Registration Exercise has long been a fixture in the young parents' list of concerns – stories of parents starting to strategise about where to live or which school to volunteer at even before their child has been born are not uncommon. This paper builds upon years of research into school choice and mechanism design and draws upon the successful reform of the Boston mechanism as an impetus to prompt the reexamination of the Singapore mechanism.

As expounded upon in the previous section, the proposed altered DA mechanism has the following properties: (1) strategyproofness, (2) fairness, and (3) nonwastefulness, making it a more preferable system to the existing one. It also has its advantages in practical implementation; the current system is a long-drawn process that takes place annually from July - November, whereas the new system would only need parents to submit a ranked list of preferences once, eliminating the need for in-person registration and phased admission. Theoretically, the exercise could be concluded in one afternoon. The transparency of the process would also be improved, and parents can be told to submit their true preferences rather than be urged to strategise and "game" the system.

In closing, it is important to note that this paper does not tackle normative questions like whether or not it would be a good idea to remove distance-priority or phase quotas; research has shown that that quotas can actually be detrimental to the minority it tries to protect, because they potentially make competition for other schools higher. [4] These important questions warrant future investigation within the Singapore context, and are worth consideration should the Ministry decide to redesign the Primary 1 Registration Exercise.

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