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CAN DEFERRED ACCEPTANCE WORK IN INDIA? A SURVEY ON MATCHING PREFERENCES AND POSSIBILITIES

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Abstract

This paper examines the application of a widely recognized preference matching deferred acceptance (PMDA) mechanism in India's educational marketplaces, concentrating on the decentralized selection processes in college and school admissions. We conduct a comprehensive analysis of four markets by examining webpages and official documents, correlating our findings with the current literature on matching marketplaces to elucidate the issues pertinent to each market. We recognized the current challenges resulting in inequitable assignments and provided enhanced solutions for each problem, along with market-related concerns, by delineating the scope of a PMDA-based procedure. The Indian markets are experiencing challenges related to under-admissions, over-admissions, agent strategic actions, congestion, and a deficiency of transparency and equity in admission and selection processes. We determined that there is a significant potential for the introduction of an equitable matching mechanism such as PMDA.

Keywords: Preference Matching, Matching Markets, India, Education, College Admissions.

1. INTRODUCTION

Among the most important roles of markets is "Matching." Who marries, who gets which jobs, and whose schools? Who all influence people's professions and life? (Gale & Shapley, 1962). The same is dealt with via preference matching. This study delineates the essentials of the preference matching idea and examines its potential applications in India. Numerous markets have been identified where the concept can enhance the development of a superior selection system including either two agencies or a single agency. It has attracted scholars from several disciplines, including mathematics, economics, game theory, and computer science (Roth, 2009).The two significant contributors who developed the algorithms, Alvin E. Roth and Lloyd S. Shapley, won the Nobel Prize in 2012 for the ground-breaking discovery of the now widely applied concept titled "The theory of stable allocations and the practice of market designs".

Most problems researched in preference matching find their roots in their classic college admissions and courtships algorithm (Gale & Shapley, 1962). This paper presents an in-depth literature survey that investigates the scope and potential for implementing the preference matching deferred acceptance algorithm within the context of India's admissions and recruitment systems. The deferred acceptance algorithm, originally introduced in the field of market design, has been widely applied in various international settings, such as school choice programs and medical residency matches. However, despite its success in optimizing allocation mechanisms globally, its application and study within the Indian ecosystem remain relatively limited.

India’s highly competitive and diverse education and employment markets present a unique set of challenges and opportunities for algorithmic intervention. These include factors such as multiple tiers of institutions, heterogeneous applicant pools, regional preferences, reservation policies, and the coexistence of centralized and decentralized decision-making processes. Given these complexities, this paper seeks to explore how the deferred acceptance algorithm can be tailored or extended to suit these specific institutional features.

In addition to reviewing the existing body of work, the paper will also identify gaps in the literature and suggest directions for future research, particularly in adapting the algorithm to Indian-specific constraints and socio-economic dynamics. To enhance understanding and accessibility, especially for readers from diverse backgrounds including mathematicians, economists, policy researchers, and educational administrators, the paper will incorporate a number of detailed, step-by-step examples. These examples are designed to clarify the algorithm's mechanics, highlight its advantages over traditional matching methods, and demonstrate its potential for real-world impact in the Indian context.

Ultimately, the goal of this paper is to not only synthesize relevant academic research but also to serve as a foundational resource that encourages broader discussion and experimentation with algorithmic market design in India's education and recruitment systems. The Indian literature reflects a significant gap in the study of this subject and remains largely underexplored in the context of Indian research with a handful of studies (Baswana et al., 2019). This paper aims to bridge this gap in the literature.

Section 2 constitutes a literature review on matching, PMDA, and the various varieties of PMDA. Section 3 examines the present condition of Indian matching marketplaces, detailing the processes, their constraints, and solutions utilizing PMDA. The discussion is presented in section 4. Section 5 serves as the conclusion, providing a summary of the paper.

2. LITERATURE REVIEW

The inception of the 'Matching Plan for Internship Appointments' dates back to 1950, where the matching of students in medical college was proposed (Mullin & Stalnaker, 1952). The report offered an equitable approach that introduced the concept of a "Clearing House," serving as a centralized entity for aligning students with college preference lists (*National Resident Matching Program*, 2024).

Later, in 1951 "National Resident Matching Program" implemented the new cooperative plan for the selection of medical students as residents in medical colleges (Mullin, 1951). The procedure inevitably was an improvement over the previous cooperative plan in terms of time compression and assignment of the desired college to the more deserving candidate with fewer vacant seats in comparison (Mullin & Stalnaker, 1952). Gale & Shapley (1962) gave the concept of "College admissions and Marriage proposal," similar to the medical admissions concept. Later, it was established that the college admissions algorithm in Gale & Shapley (1962) and medical admissions problem are the same (Roth, 1984). The courtship or Marriage proposal problem is a special case of college admissions problems where there is the same number of applicants as colleges, and all quotas are unity (Gale & Shapley, 1962).

Roth has made a remarkable contribution with three key papers supporting the theory of stable allocations and its practical implications in various markets. These three papers (Roth, 1982, 1984, 2003) discussed the application of matching from an economics and game theory perspective in medical residents and job matching problems.

Irving (1987) proposed a modified and more efficient form of "optimal" stable marriage algorithm using the graph-theoretic method. Roth and Sotomoyer (1992) summarised their knowledge of stable matching along with fundamental theorems and empirical findings. In 1998, NRMP replaced the college-proposing algorithm with the applicant-proposing algorithm presented in Roth (1997). The paper compared both algorithms to see which one was more effective and concluded that both algorithms produce the same results. In fact, the applicant-proposing algorithm was more effective by 0.1 per cent compared to college proposing (Roth & Peranson, 1997).

From 2000 to 2009, a study of seven key papers (Abdulkadiroglu et al., 2005; Eeckhout, 2000; Gale, 2001; Irving, Manlove, & O'Malley, 2008; Irving, Manlove, & Scott, 2008; Iwama & Miyazaki, 2008; Roth, 2008) shows how preference matching was found to be relevant in various fields. Numerous two-sided matching mechanisms exist in the current literature, which has practical applications across the globe in different countries, including the US, UK, Turkey, China, Korea, and so on (Roth, 2002).

Along with a two-sided matching mechanism, there are also market designs that work on one-sided matching mechanisms wherein with only one side having preference and the other side doesn't show any strategic behaviour and is an object to be consumed, for example student placement problems and hostel room allocation (Abdulkadiro & Sönmez, 2013; Balinski & Sönmez, 1999). Similarly, depending on how many allocations have to be made or how many units have to be allocated to a single agent there can be one to many matching algorithms, many to many matching algorithms, and one to one matching algorithms (Ren et al., 2021). In this wide existing spectrum of literature there are assignments which are also made by market and non-market mechanisms (Condorelli, 2013).

When we talk about market mechanisms it is about using currency to assign objects or agents to the other side for example auction and bidding and when we say non market mechanism be mean those kinds of markets where using currency is not as informative as focusing on some other characteristics of the market such as markets where government intervention is required for example in college admissions process where students cannot bid for a seat and colleges also decide based on some merit scores which students are acceptable (Condorelli, 2013). Another example of such a market is assigning organs to the most suited patient. In such examples, matching is done under non-currency means, for example, under preferences, lottery or priority.

However, deferred acceptance is one of the most famous algorithms for assigning the proposing agency the desired preference. One agency proposes in the algorithm, and the other defers or delays the proposal until the best possible (optimum) matching is reached. Both agencies have their preference lists. Agents on one side of the market make proposals (offers or applies) to agents on the opposite side in order of preference (Gale & Shapley, 1962; Roth & Sotomayor, 1992).Those who receive more offers than they can take reject the ones they do not want, but they do not accept the ones they do not reject right away; instead, they hold them without committing to them, and acceptances are deferred until the algorithm is finished.

2.1 Definitions

Stable: Gale and Shapley (1962) defined "An assignment of applicants to colleges will be called unstable if there are two applicants a' and b' who are assigned to colleges A and B, respectively, although, b' prefers A to B and A too prefers b to a."

Optimal: A stable assignment is optimal if every applicant is at least as well off under it as any other stable assignment.

2.2 PMDA: two-sided Vs. one-sided

Depending on whether one agency or both agencies have a preference list, matching can be of two types (discussed in detail in the subsequent subsection). The first is two-sided matching, with both the agencies having their respective preference lists, and matching is done considering both lists. The second is one-sided matching, where either one of the agencies has the preference list, and matching is done by considering the only preference list declared. For better understanding, we have also given two examples for each type.

2.2.1 Two-sided preference lists

Matching problems where both the parties have preference lists. Examples are:

1) **Marriage proposal or courtship problems**:(1:1) Matching. Iwama & Miyazaki (2008) mentions that the stable marriage problem is a classic example of two-sided matching. The problem is finding a match between men and women, considering preference lists in which each person expresses their preference over the members of the opposite gender. This is a one-on-one matching where the number of men equals the number of women, and each man can have one partner only.
2) **College admissions -**(1: n) Matching. As mentioned by Gale and Shapley (Gale & Shapley, 1962) In college admissions problem, in this problem colleges with declared quota *qi,* such that admission proposal is made to more than *qi* applicants. So here, one college is proposing admissions to more than one candidate (*qi* offer letters*).* This problem becomes one-to-many matching.

2.2.2 One-sided preference lists

Matching problems where only one party (or agency) has a preference list. Examples are:

1) **Hostel allocation –** In a standard hostel allocation problem, "n" students have their choices for "n "rooms. Here, only students have a preference list and not the other agency. The assignment of rooms is done based on one list.
2) **Elective courses** (With limited batch size)-When the batch size is limited and fixed for any elective course *"n,"* (say n= 60 students) in any program. The number of students applied for the course is more than "*n*" (say 75 students), then only *"n*" (60) students will be assigned seats, rejecting the requests of remaining 15 students. The course handling agency selects the "n" students based on its preference list. Here, the student does not have a preference list, but the deciding agency has the list of top *"n"* students, and it will offer admission if the applicants are more than *"n."*

2.3. The two variants of PMDA

There are two variants of the Deferred Acceptance Algorithm proposed by Gale and Shapley (1962). One in which the proposing agency is the Institute, and the candidate defers or rejects. This is called College Proposing Deferred Acceptance (CPDA). CPDA gives colleges optimal solutions. The other variant is the one where the proposing agencies are the candidates, and the agencies which defer or reject are the institutes/colleges. This is called Student Proposing Deferred Acceptance (SPDA).

2.3.1 College-Proposing Deferred-Acceptance Algorithm (Gale & Shapley, 1962):

The algorithm's steps are similar to what happens in a typical market (without any clearing house). Students on the confirmed list will be offered admission by each college. If a student on the confirmed list declines the offer (because they have already been accepted into their desired college), a student from the waitlist will be transferred to the confirmed list. transfer of students from the waitlist to the confirmed list will continue till all the seats are accepted by students (i.e., no vacancy) or the end of the waitlist, whichever is earlier.

The students who receive a single offer will accept the offer. Those who receive multiple offers will accept the most preferred one (all other non-accepted offers are automatically rejected).

The student who has already been admitted and receives an offer from

i. a higher preferred college: s/he will be admitted to the higher preferred college, and their admission to an already accepted lower preferred college will be cancelled.
ii. a lower preferred college: s/he will not accept the offer, and it will be cancelled.

The above-mentioned process can be run with or without any third-party clearing house. If there is no clearing house, it needs some reasonable time to complete all possible iterations. If it is coordinated by the clearing house, it can complete all possible iterations in one application (all colleges will submit their merit lists, and all students will submit their preference lists to the clearing house). The obtained matching is stable and optimal for college.

2.3.2 Student-Proposing Deferred-Acceptance Algorithm (Gale & Shapley, 1962):

Students will make a college proposal (one college at a time).

Assume that n_c is the number of seats available at c^{th} college.

A student will make an admission offer to the college of their choice. If a student is denied or not accepted at their first-choice college, they will apply to the next available college until they are accepted at one of the universities of their choice.

A college can tentatively accept top n_c students at most. If any student makes an offer to a college,

i. where the number of tentatively accepted students is less than nc, then s/he will get a tentative acceptance.
ii. where the number of tentatively accepted students is nc and s/he is preferred than the least preferred student among the tentatively accepted students, then s/he will be accepted, and the least one will be removed from the tentatively selected list of students,
iii. where the number of tentatively accepted students is n_c and s/he is less preferred than the least preferred student among the tentatively accepted students, then s/he will not be accepted.

The above-mentioned steps (students making an offer to colleges and a response by colleges) will be repeated until all students attempt. At the end of the algorithm, the tentative list converts into the permanent list, and all the students get their final and non-changeable optimum choice. Ultimately, all tentatively accepted students are matched to the respective college.

The matching obtained is stable and student-optimal.

In SPDA, some students are more preferred than others, and all colleges have a common preference list. Even when college lists are different and students' lists are shared, at least one stable solution always exists. An example of one unique stable situation is the condition of "uniformity," with a perfect correlation. In these cases, there is just one unique stable solution. (One example is- JEE counselling, later discussed in section 3)

2.3.3 CPDA Vs. SPDA

Practical implementations have shown that SPDA is better than CPDA. Though there is an improvement of less than 1 per cent (0.1 per cent is usually the rate), more than 99 per cent matching done by SPDA is the same as is done by CPDA. Later, in 1998, the National Residence Matching program in the US shifted from CPDA to SPDA (Roth, A. E., & Peranson, E. (1997). Currently, it is using the applicant-proposing algorithm. Roth and Peranson (1997) compared both algorithms to conclude which algorithms provided better results in the context of receiving better and worse matches. They concluded that fewer than 1 in 1000 applicants receive a different match when SPDA replaces CPDA. Considering the algorithms, they also conclude that if any college has vacant seats in any stable matching or any student is not matched to any college. The same thing will happen in all the stable matchings. For example, if two seats are vacant in College C1 in CPDA, then even in SPDA, two seats will remain vacant in College C1.

3. STATUS OF MATCHING MARKET IN INDIA

On exploring the web and official websites, numerous markets where preference matching is applied were identified. The range varies from college admissions (MBA, Engineering, UG courses) to job markets (Banks and others). Some important ones are listed here and further classified into subcategories.

3.1 College Admissions

3.1.1. Master of Business Administration entrance (All B-Schools)

In India, the Indian Institute of Management (IIMs) and other reputed B-Schools are admitted separately for MBA courses. As of now, there is no centralised system as a clearing house. The qualifying examination is the Common Aptitude Test (CAT) for IIMs and other institutions (which admit CAT scores). Besides CAT, separate university-level entrance examinations are conducted by reputed private institutes.

Scope: Currently, each Indian Institute of Management (IIM) operates independently when it comes to admissions, following its own academic qualifying criteria and internal selection process. The list of selected candidates and the entire admission cycle are exclusive to each individual IIM, with no centralized mechanism in place to coordinate candidate selections across institutions. As a result, many candidates receive admission offers from multiple IIMs simultaneously and delay their decision to accept or decline, waiting for better offers. This leads to significant time delays in the clearance of waitlists, especially for the less preferred or lower-ranked IIMs, which must wait for top candidates to finalize their decisions before moving forward.

Introducing a centralized clearing house system, similar to those used in global education markets, can effectively address this issue. A clearing house would act as a common platform to collect student preferences, rank choices, and match candidates to institutions based on merit and preference order using standardized algorithms like deferred acceptance. This would reduce delays, minimize uncertainty, and ensure a more efficient, transparent, and streamlined admission process. Institutions would be able to fill seats faster, and students would be matched with the best possible option based on their preferences and qualifications, benefiting both parties.

3.1.2. Engineering Entrance (BE/B. Tech/B. Arch etc.)

Engineering admissions in India happen at multiple levels: National Level Entrance Examinations, State Level Entrance Examinations, Deemed University Entrance Examinations, and Direct Admissions (Students can apply for engineering courses based on 12th scores in a few institutions where seats are not fixed.)

Admissions in IITs, NITs, IIITs, and GFTIs (IITs, NITs, IITs are institute of national importanc (The full forms of these are given in Annexure A) happen through Joint Seat Allocation Authority (*The Joint Seat Allocation Authority (JoSAA),* 2024)[1]. All the candidates who are eligible for admission will have to participate in the joint seat allocation process by filling in their preferred choices of courses and institutes. A category-wise combined rank list is released. The qualifying examinations are JEE Mains(*JEE Mains*, 2024) and JEE Advanced (*JEE Advanced*, 2024). JoSAA organises multiple counselling rounds (around 7-8) for admissions as per the merit list. The participating institutes comprise around 110 colleges (23 IITs, 31 NITs, IIEST Shibpur, 26 IIITs, and 29 Other-Government Funded Technical Institutes (GFTIs)).

For the vacant seats after JoSAA counselling, admissions in NITs, IIITs, GFTIs are made through CSAB (*Central Seat Allocation Board*, 2024). CSAB selection procedure only considers JEE Mains scores. Here, Both JoSAA and CSAB are counselling bodies acting as a centralised clearing house (Baswana et al., 2019).

Scope: The multi strata system adopted by IITs and NITs, by performing two separate examinations- JEE advance and JEE, mains is effective as it filters out the best candidates for IITs by conducting a separate –more difficult examination. This type of multi strata system is effective where the student and college distribution is vast. This is an example of SPDA preference matching. For the current system, the admission process seems to be effective enough, leaving no space for improvement regarding better marching procedures.

3.1.3. Undergraduate (UG) Courses at Delhi University (All fields)

In Delhi University (*Delhi University*, 2024)**,** merit-based admissions in UG courses are made in various fields based on cut-off criteria. Eligibility criteria are based on 12th overall scores and scores in relevant subjects, as per cut-offs and students' pre-filled choice of colleges and fields.

Scope: In the current admission process, students are typically required to declare only their *choice* of college or program, rather than a ranked *preference* list. This limits the ability of institutions like Delhi University (DU) to effectively match students to colleges based on both merit and genuine interest. When students submit multiple choices without prioritizing them, it becomes difficult to identify which college or course is most desired. If DU were to implement a system where students not only list their choices but also rank them in order of preference, the allocation process could become significantly more efficient and student-centric. This approach would allow DU to match students more accurately with their highest preferred college or course that aligns with their rank and eligibility. Such a preference-based system would also reduce random allocations, minimize seat vacancies due to mismatches, and improve overall student satisfaction with the admissions outcome.

3.1.4. Entrance to Intermediate Courses in Bihar

The Bihar School Examination Board (BSEB) has developed a web-based system known as the Online Facilitation System for Students (OFSS), which will allow students to enrol in Intermediate courses in various fields and various Colleges/ Schools affiliated (*Online Facilitation System for Students*, 2024). These colleges/schools are affiliated with BSEB and are scattered in 38 districts of Bihar. Students can only provide a preference of a minimum of 10 and a maximum of 20; in the declaration of preferences, one college and one specialisation are considered one preference. This means that one college and two specialisations are considered as two preferences. The OFSS system for admissions in colleges in Bihar is one step ahead of the DU process in that it considers both the "Choices and preferences" of students. It makes the assignment process easier. The major limitation of the OFSS process is that the preference list is short (Maximum is 20). Additionally, the list, once filled, cannot be modified in later stages

Scope: The short preference list makes the procedure unfair to a more deserving Candidate. This limitation is easily fixable and can be easily understood by the following example. Consider a situation where Student A and Student B both have qualifying scores such that Student A's score is better than Student B's. When they filled in their preferences, student A filled in as per their wish till choice 15th, whereas for the last five places, he/she made choices that were not in their best interest but only to get admission in any college. On the other hand, Student B filled out all 20 choices based on his desired top colleges.

In this case, there is a chance that even though student A is more desired by some moderately ranked college C, based on scores. The college may offer admission to student B, as B ranked college C higher than college A on their list. Student A will settle for a less-deserved college, and College C will have lost a better-deserving candidate. This induces strategic behaviour in students, leading to undesirable matching (Ehlers, 2008).

Alternatives to Rectify This Limitation

To address the existing limitations in the current preference matching and allocation system, two practical alternatives can be proposed to enhance fairness and efficiency in the admissions process.

Alternative 1: One major limitation is the restriction on the number of preferences a student can submit, which is currently capped at 20. This limitation often forces students to make difficult choices and can result in the exclusion of several deserving colleges or courses from their application. To rectify this, the cap on the list size can be increased to allow students to include a broader range of colleges and programs. Expanding the list size will enable students to apply to more institutions that genuinely align with their academic goals and interests, thus reducing the chances of being left out of preferred options due to arbitrary limits.

Alternative 2: Another approach involves releasing multiple merit-based lists, categorized by college rankings or selectivity tiers. For example, a first list could be released for the top 10 colleges, followed by a second list for the next ten colleges, and so on. These lists could be structured based on historical data such as opening and closing cut-off scores from previous years. Such a tiered release strategy would help students to realistically assess their admission chances and make informed choices accordingly. This would reduce uncertainty and increase transparency, allowing students to align their preferences with colleges they are most likely to qualify for.

Together, these alternatives aim to improve student satisfaction and system efficiency.

4. DISCUSSION

Preference matching and deferred acceptance algorithms have always found relevance in multiple fields and aspects of life. We understand the logic and reasoning behind both the deferred acceptance algorithms and how they differ from each other. We tried to illustrate the algorithm in a language compatible with "all" and not only with mathematicians. The concept itself was first discussed in such language, and the beauty lies with the very fact that Mathematica is simple and applied and not just about figures and complicated equations.

We also see the importance of preference matching and deferred algorithms in various job markets of India. In India, we see that mainly in the college admissions type scenarios, some matchings are not coordinated by the clearing houses; hence, optimal matching is not achieved. JEE Mains also implement SPDA for engineering admissions. We make some critical observations for all the job markets that provided us the current structure along with the limitations and scope.

The Multi strata system adopted by IITs and NITs is effective by performing two separate examinations- JEE advance and JEE mains. It filters out the best candidates for IITs by conducting a separate –more difficult exam. This type of multi strata system is effective where the student and college distribution is vast. In Delhi University admission process, Students only declare their "choice" of college and not "preference." It will be easier for DU if it can take Choice as well as Preference from students. The OFSS system for admissions in colleges in Bihar is one step ahead of DU process in the context that it considers both the "choice & preferences" of students. It makes the assignment process easier. Inter market cases, especially in Govt. Jobs it is observed that same candidate appears in multiple exams and since the selection process of the exams is independent/separate. There is no way for the conducting bodies to know whether the candidate has multiple offers, whether they will join or not.

This creates a need to have a centralised system to improve transparency and to avoid delays in recruitment.

We also discuss how NRMP replaced the college proposing algorithm by the applicant proposing algorithm in 1998. It is essential to mention that in the NRMP selection process, there is no scope for withdrawal. Meaning once an applicant gets a seat assigned, they cannot withdraw from the program. This, however, is not the case in Indian Markets, considering that SPDA possibilities are there. In India, we do have the option of withdrawal. For example, we can state both OFSS and MBA admissions procedures, which provided the withdrawal options to the candidates. This provision of withdrawal complicates the process and exerts the need to apply additional optimality charges compared to CPDA. This makes implementing SPDA challenging in India. To put it in other words, it is not easy to arrange the SPDA method, even so, if the market size is not considerably big.

Though SPDA is witnessed in the case of some job markets (In India, JEE mains), it is essential to realise that implementing SPDA has certain implied conditions. For instance, it is only relevant to replace the CPDA with SPDA if the market size is big enough with more extensive student and college distribution. We also establish that SPDA and CPDA almost give the same matchings except that SPDA is better by less than 1 percent over CPDA.

Still, given our prime focus, which is students should always get the upper hand to decide which college is the best for them, it is advisable to see the feasibility of implementing SPDA in the markets where the size is comparable to the already SPDA driven engineering market.

5. CONCLUSION

Centralised matching algorithms are successful only when they give "stable matchings." Each candidate and the college should get their best choice as per their merit lists. Some key observations were made while understanding the matching algorithms.

No matter how many merit lists are submitted, at least one stable match can always be found.

A "college-optimal" stable matching and a "student-optimal" stable matching are always included in the collection of stable matchings. A "college-proposing" algorithm generates college-optimal stable matching, in which colleges make proposals to candidates, starting at the top of each college's merit list and allowing students to hold the most favoured offer among those received thus far at any stage in the process.

The college-optimal stable matching is produced by a college-proposing algorithm in which colleges make offers to candidates starting from the top of each college's merit list and allowing candidates to hold at any point in the algorithm the most preferred offer among those so far received. A comparable "student-proposing" technique produces students-optimal stable matching. The same students are unmatched at every stable matching, and the same slots are empty. No student can improve their match by supplying a merit list that differs from their genuine preferences when applying the student-proposing algorithm.

In India, procedures similar to deferred algorithms are quite visible in all college-admissions like markets. We see that in almost all the courses, be it MBA, UG Courses, and Intermediate, all are performing college proposing algorithms. Considering both SPDA and CPDA. We also see that if any college has a vacant seat in any stable matching or any student is not matched to any college, then the same thing will happen in an all-stable matching.

SPDA is performed by the JEE counselling bodies (Clearinghouse) for admission in engineering programs. The multi-strata counselling procedure is no doubt one of the best examples of student-proposing algorithms. In this case, we see the condition of "uniformity," where there is a unique stable solution. This market is massive in terms of the number of applicants applying and a dense and diverse college distribution. These factors allow easy implementation of SPDA.

This further provides a direction towards future development. It will be interesting to compare and see if SPDA and CPDA will reach the same optimal solution in Indian job markets.

Let's take the case of OFSS, Bihar. There is a significant opportunity to do the SPDA Vs. CPDA comparison and accordingly check for the feasibility of SPDA implementation. The market size based on students and college is comparable to the engineering field.

Again, in the case of OFSS, we also discussed the limitations of having a bounded-short preference list. This leads to unfair assignments of students to colleges. One of the most important purposes of matching is to match a deserving candidate with a more deserving college and vice versa. We also propose two alternatives that can be implemented to rectify this limitation. The survey most likely covered the markets in India, which reflect the preference matching application more visibly. It did succeed in identifying the limitations and appreciation points of the few identified existing matching markets.

Still, the study can further be extended to other unidentified markets that are not considered here and can be viewed more from the SPDA perspective.

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Table I: Summary of All Markets-Characteristics Defined Under Headings

	MBA	Engineering	DU	OFSS
Market	B-school for admission to MBA	1. IIT and NITs separate Exams-Mains and Advanced. 2. Other exams for admission to B. Tech.	Colleges and Uni. Depts of DU	For +2 Admission in Bihar
Merit-list	Separate	Unified single merit list	Cut-offs and Merit list	Cut-offs and Merit list
Procedure	Agency-proposing, sufficient time.	Counseling System, Student-proposing.	Agency-proposing, limited time.	Counseling System, College-proposing.
Centralised	No	Yes	Yes, No	Yes, Yes
Withdrawal	Medium to Difficult	--	Easy to Medium	Easy to Medium
Joint preference	Rare (Very Low)	Yes (Moderate)	Yes (High)	Yes (High)
Common Lead Time	Yes	--	Yes	--
Outside-Market Exit Option	Yes	Yes	Yes	Yes
N-period model	No	No	No	No

Annexure A

Acronym Full-Form

BITSAT Birla Institute of Science and Technology Admission Test

CAT Common Aptitude Test

CPDA College Proposed Deferred Acceptance

CSAB Central Seat Allocation Board

GFTI Government Funded Technical Technical Institutes

IBPS Institute of Banking Personnel Selection

IIEST Indian Institutes of Engineering Science and Technology

IIM Indian Institutes of Management

IIT Indian Institutes of Technology JEE Joint Entrance Examination

JoSAA Joint Seat Allocation Authority

NIT National Institute of Technology

RBI Reserve Bank of India

RRB Regional Rural Banks

SBI State Bank of India

SPDA Student Proposed Deferred Acceptance