MASTER OF TECHNOLOGY PROJECT REPORT

BTO Recommender system

TEAM MEMBERS
CHANG YE HAN-1
CHUA ZHEN LIANG DESMOND-2
CHEE JIA WEI-3
GANESH KUMAR-4
GOH YU CHEN-5
JEANETTE TAN YI WEN-6

MASTER OF TECHNOLOGY

1.0 EXECUTIVE SUMMARY

Singapore ranks amongst countries with the highest population density in the world. In a bid to have firm control over long term urban planning, the Singapore government came up with the "Built to Order" (abbreviated BTO) initiative back in 2001. These are new Housing Development Board (HDB) flats tightly controlled by their eligibility and quantity released every year. In more recent years, the modern BTO scheme in Singapore requires a waiting period of 3-4 years, and is generally targeted at young Singaporean couples looking to purchase their first property and set up a family. Nationality and income ceilings are some of the broad filters that determine one's eligibility for the highly sought after projects.

Our team, comprising of 6 young Singaporeans, all hope to be property owners one day. Many of our peers opt for BTO flats due to their affordability, existence of financial aid from the government, as well as their resale value. However, there often exists a knowledge gap for these young couples during the decision making process and they end up making potentially regretful decisions. We would like to bridge this knowledge gap, and have hence chosen to base our project on creating a recommender system for BTO flats, utilizing the data from recent launches in Tampines, Eunos, Sengkang and Punggol.

Using the techniques imparted to us in lectures, our group first set out to build a sizeable knowledge base via conducting an interview and administering a survey. While building the system, we utilized tools such as Java to scrape real time data from HDB website and transform it into a database, CLIPS to synthesize the rule based reasoning process, and Python to integrate it into an easy to use UI for the everyday user. To add icing on the cake, we even hosted the system on a website so that the everyday user can access it through the click of a link.

Our team had an amazing time working on this project, and hope to share our insights with everyone. Despite a focus on BTO flats, we would recommend it for everybody interested in understanding property market trends for residence or investment purposes. There truly are a wide array of factors behind the decision to invest in a property, and we only wish there was more time to work on the scope and scale of the project.

2.0 PROBLEM DESCRIPTION

Buying property is often hailed as the largest financial purchase anyone will make in their life. This is especially so in the modern context, as property prices represent an ever increasing percentage of one's monthly salary. Most people in Singapore take a housing loan which is typically paid over the duration of 30 years. With such a large financial commitment over an extended period of time, it is imperative that young couples make the right decision behind their first property purchase.

There are a lot of questions to be answered by the buyer(s). What is the most suitable flat based on our budget and grants available? What if the buying party cannot come to a common consensus as to which factors they would prioritize? Is this going to be a good long term decision given the years of commitment to a loan?

Our teammate, Jia Wei, was also recently faced with this daunting task. He was recently successful in bidding for a BTO unit in Punggol with his fiancé. However, he also felt that they could have made a more intelligent decision had they been more aware of the differences between the BTO options, and the factors that drive the long term value of their purchase.

We hypothesize that a fair number of people have not put in sufficient thought into the decision and come to regret it several years later. They merely purchase the "Best Option" available to their budget. Best in what sense? They may not even be able to describe it. Many don't even know what they want when purchasing a flat – this was something we realised after interviewing our subject matter expert, as there were several factors that none of us had been aware of. We hope to close this information gap for home owners, and guide them to reach a decision only after being equipped with the right knowledge.

2.1 PROJECT OBJECTIVE

Our group aims to create an efficient algorithm that can identify the most suitable BTO unit for potential homebuyers. This algorithm will take into account factors such as the buyer's spending power and their family nucleus amongst many others. We will guide users to identify factors and housing amenities that they may not have been aware of previously. As the project is focused on BTO units, it would be most useful for young Singaporeans, who have formed the bulk of buyers since the inception of this idea.

As reflected in our survey results, the majority of respondents plan to purchase their property as a couple or group. When there are multiple decision makers, conflicts are inevitable. Our algorithm is a fully rational, impartial system to help handle disagreements. Although there are over 4000 possible units in our database, our system can generate features of the ideal unit, and intelligently return the available ones based on data extracted from HDB.

Another important benefit of our system is continuity. Since BTO data is readily available on government websites, the project can be extended to future housing projects by modifying the database – making this a sustainable and long term endeavor that can benefit users for a good number of years until property trends change.

While CLIPS and other programming tools may be too complicated for the everyday user to learn, by combining all the tools together, our group has a recommender system hosted on a website that is easy and intuitive to use.

3.0 KNOWLEDGE MODELING

Knowledge modeling can be decomposed into three main stages (Schreiber, et al., 2001), namely

(i) Knowledge identification
(ii) Knowledge specification
(iii) Knowledge refinement

Various activities are carried out during each of these stages and the crux of model construction lies in (ii) Knowledge specification.

3.1 KNOWLEDGE IDENTIFICATION

Knowledge identification sets the groundwork for the next stage encompassing knowledge specification. Information sources that are deemed to be useful are identified in preparation of knowledge acquisition. In the context of building a recommender system for BTO flats, three main sources have been identified and are documented in *Table 1*.

Table 1: Knowledge source and acquisition technique

S/N	Source of information	Insights from information source	Knowledge acquisition technique
1	HDB website	It provides basic information on public housing such as: - Types of available flats - Characteristics of available flats which include location, price and unit layout - Eligibility	Web scrapping to obtain publicly available/documented information (Housing & Development Board, 2018)
2	Real estate agent	The subject matter expert, accumulated with years of experience, will be able to: - Identify and explain the considerations in choosing a HDB unit and how they arise from the needs of home buyers - Validate or further reinforce our understanding from the HDB website	Elicitation of tacit knowledge through the conduct of interview
3	Generic population	To validate and support the claims from the real estate agent with data	Elicitation of tacit knowledge through analyzing results of a survey from the general population

3.2 KNOWLEDGE SPECIFICATION

A two-pronged approach is taken at this stage to (i) bring insights out of the unstructured data from the HDB website and to (ii) formalize the problem-solving domain knowledge. The former requires the establishment of a complex scoring matrix while the latter encompasses the process of knowledge acquisition.

COMPLEX SCORING MATRIX

Data from the HDB website does not indicate distances between flats to amenities which is an important discriminant. Hence, the team has employed heuristics to develop an array of matrices consisting the relative score of a HDB unit based on its proximity to amenities. Each score is divided into two categories, micro and macro. The former evaluates units within the same project whereas the latter evaluates units across projects. The score, z_i, is computed by adopting the min-max normalization approach in equation (1) below:

$$z_i = (b-a)\frac{x_i - min(x)}{max(x) - min(x)} + a, \quad where\ x = (x_1, \dots, x_n) \qquad (1)$$

The score z_i is then assigned to the HDB unit and can be used for system evaluation for recommending HDB units. Other variables such as a and b are nominal values assigned as a factor. Figure 1 provides a pictorial illustration of how the micro scores could be determined between two units in a HDB project – Tampines Green Court. The blue marker, located further away from the mrt compared to the red marker, will be assigned a larger score compared to the red marker. The higher the value, the further the unit with respect to the nearest MRT with a ceiling value of 10.

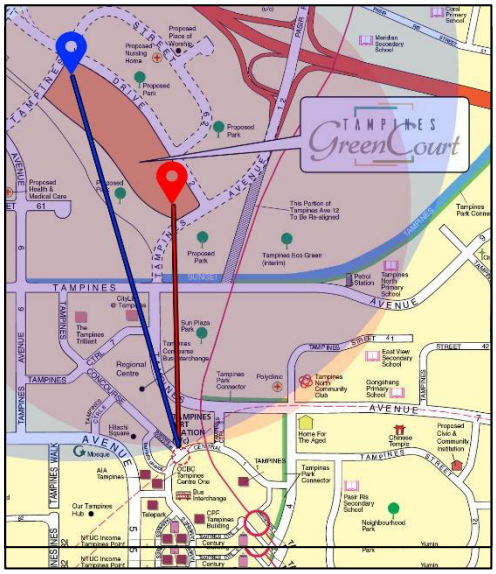


Figure 1: Illustration of min-max normalization approach

3.3 KNOWLEDGE ACQUISTION

Following from the identification of knowledge sources, knowledge acquisition is conducted to capture the problem-solving domain knowledge. The techniques adopted to acquire the knowledge have been described in Table 1 and the corresponding results are presented using a dependency diagram as shown in Figure 2.

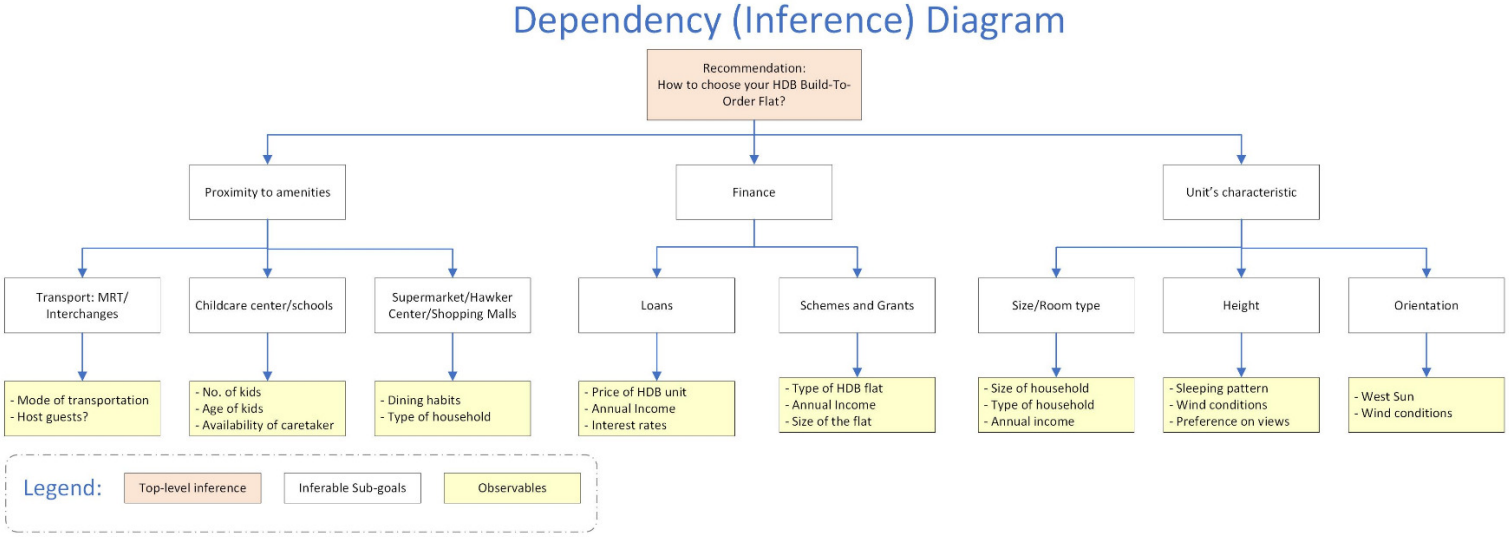


Figure 2: Dependency diagram of BTO Recommendation System

The dependency diagram arranges the factors affecting home buyers' choice of HDB units in a hierarchical tree structure. The top most level node represents the decision of the proposed system, which in this case, recommends a group of HDB units to the user. This decision can be broken down into multiple layers of inferable sub-goals or sub-factors before arriving at a list of "observables". These "observables" are gathered from users of the proposed system and they represent their inherent preferences. *Table 2* illustrates an example using the dependency diagram in *Figure 2*.

The inferable sub-goals together with the "observables" are in fact, derived from the advices and insights provided by the real estate agent who is also the subject matter expert in this context. He advised the team on the various types of factors (proximity to amenities, finance considerations and unit's characteristics) that could affect a person choice's of HDB flat. To provide another example, he has also shared with us that units on the higher level tend to be windier while units on the lower level tend to be darker. In addition, units with rooms or windows facing the west tend to be hotter during the evening. Hence, this suggests that to comprehend the home buyers' choice of flat, there is a need to understand their lifestyle and it is done so through the observables.

Lastly, the full interview transcript, together with the video, is appended in Appendix C for submission.

Table 2: Example to illustrate a branch of the dependency diagram

S/N	Category	Information
1	Observable	A family comprising working parents and young kids
2	Sub-level goal	The family described in [1] would likely be interested in a HDB unit with proximity to childcare centers/schools
3	Sub-level goal	Childcare centers/schools described in [2] are one of the three categories of amenities which have been identified. Other categories include: (i) transport and (ii) supermarket/hawker center/shopping malls.
4	Goal/top level inference	The amenities described in [3] are also one of the three main categories affecting home buyers' eventual choice of HDB units. Other categories include (i) finance and (ii) unit's characteristics.

The choice of HDB units among potential home buyers is often the reflection of their needs and personal preferences. As there are no identical individuals, the objective of determining home buyers' choice of HDB units with absolute certainty is an insurmountable task. Hence, to model uncertainties in the preferences of home buyers, the certainty factors (CF) concept is adopted in the proposed rule-based system. The associations of certainty factors to home buyers' considerations are either derived from the survey's results or from advices from the subject matter expert.

To provide an example, Table 3 illustrates the survey participants' choice of room size on the condition that they plan to have children in the future. One useful insight which can be drawn from the results is that home buyers tend to prefer larger units, in the ratio of 15:40:50, if they plan to have children

Table 3: Survey response on room size based upon the condition of having kids

Room Size	No. of responses	% of responses	Derived certainty factors
3-room	10	15%	0.15
4-room	25	38%	0.4
5-room	31	47%	0.5

3.4 KNOWLEDGE REFINEMENT

Figure 3 explains knowledge refinement as an iterative process comprising of (i) model validation & verification as well as (ii) model reinforcement. The former is conducted by obtaining results through running simulations of test cases in the existing system. The collected results are then validated with a subject matter expert who can advise for potential areas of improvements. On the other hand, the latter, considers various rooms for improvements, bolsters the existing model with the newly acquired tacit knowledge.

An example of an iteration is the inclusion of certainty factors into the knowledge model so as to manage the uncertainties in humans' preferences.

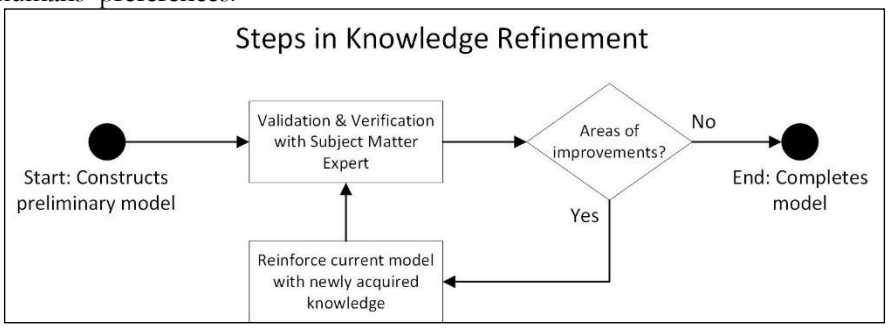


Figure 3: Steps taken in knowledge refinement

4.0 SOLUT

The development of a knowledge model in section 3 enables the structuring of a rule-base which specifies the knowledge and reasoning requirements of selecting a HDB unit. It also forms the kernel of the problem-solving strategy, which has been modelled as an assessment task, to recommend the most suitable BTO unit to the user. A detailed design of the strategy is presented using an annotated inference structure diagram as shown in Figure 4. The annotations provide examples by drawing references from the context of the project (dependency diagram). The strategy considers the inputs of the users and draws the necessary inferences which then structures the subsequent questions and influences the output result by introducing the certainty factors.

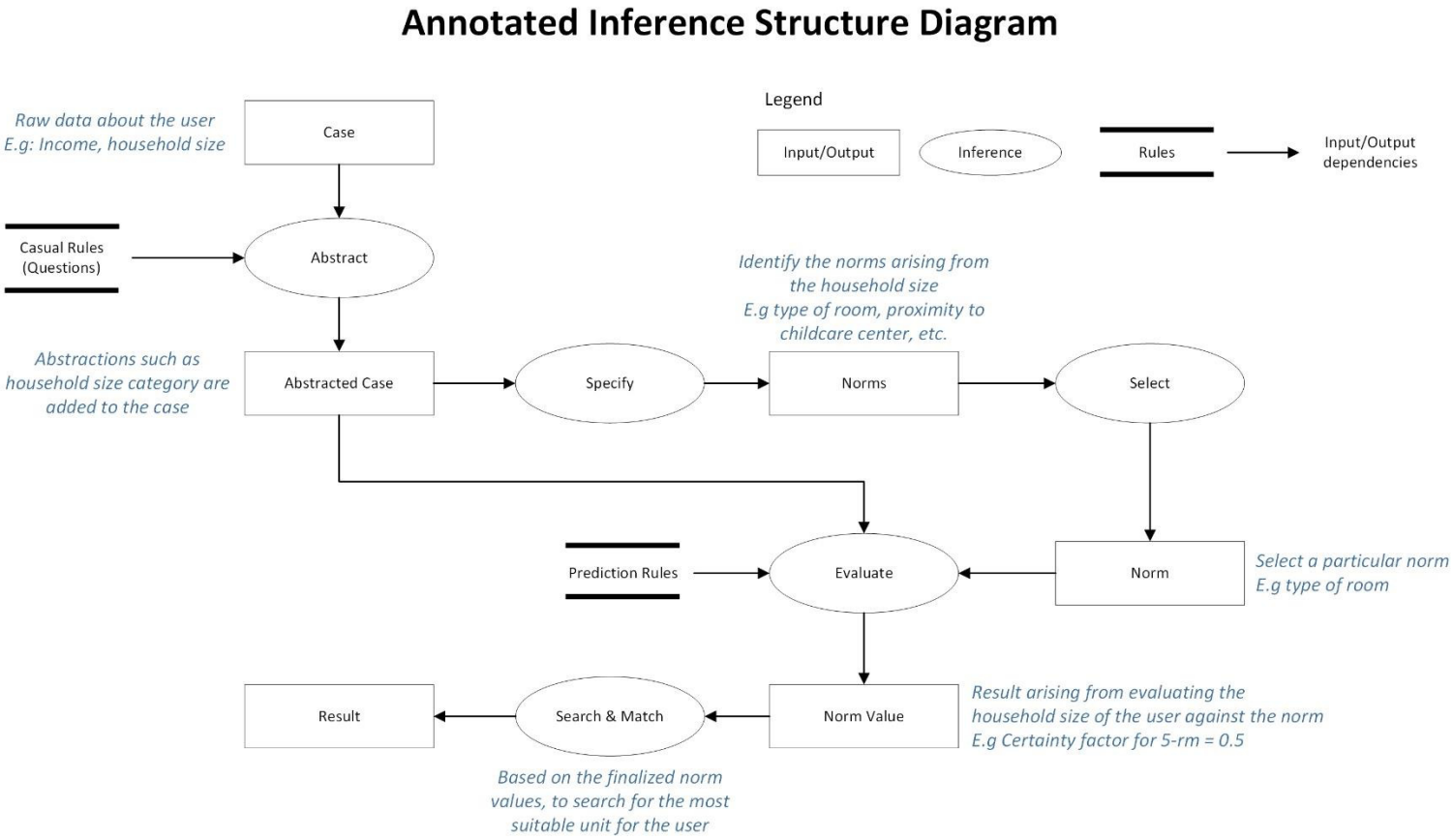


Figure 4: Annotated inference structure diagram for the HDB BTO Recommender System

4.1 SYSTEM ARCHITECTURE

Although the strategy is implemented using CLIPS, it is brought to life using Python programming language in the form of a web-based graphical user interface which users can easily interact with. Figure 5, the system architecture diagram, illustrates how the application in the front-end has been interfaced with the back-end rule-based system and relational database. The latter was created to store information on the HDB units which was digitally mined from the internet.

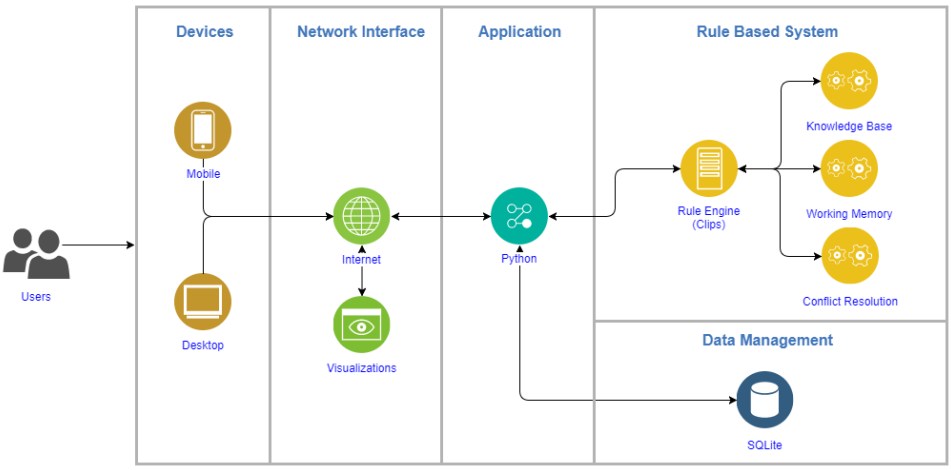


Figure 5: HDB BTO Recommender – System Architecture

4.2 PROJECT SCOPE

While data mining can be performed continuously, in the context of this project, its scope is limited by the (i) HDB sales launch in November 2017, (ii) date and time of data extraction as well as (iii) the amount of data that is available. The system provides a snapshot of the HDB units' availability and only covers a fixed number of HDB units. However, the team believes that the list of close to 5000 units is sufficient due to complexities in their characteristics.

4.3 ASSUMPTIONS

ELIGIBILITY OF USERS

While the project's target audiences are eligible HDB BTO home buyers, users from any background are also welcomed to use the system as it can better help them understand their needs and requirements. Therefore, non-eligible for HDB BTO users need to differentiate the output results from the recommender system and only draw the relevant insights. A list of eligibility conditions is provided on the HDB website and it covers a wide array of factors such as family nucleus, citizenship, age, income ceiling and property ownership (Housing & Development Board, 2017).

KNOWLEDGE ACQUISITION

Two types of knowledge acquisition processes have been described in section 3. They are (i) web scrapping of documented sources from the HDB website and (ii) knowledge elicitation through a survey as well as a subject matter expert. It is assumed that data available on the HDB website is accurate and the acquired tacit knowledge is representative of the generic population in Singapore. This is because the former has implications on the output results while the latter has an impact on the rules.

HDB POLICIES & REGULATIONS

It is assumed that HDB policies and regulations remain the same or there is no major revision that would significantly affect people's choice of selecting their HDB units.

4.4 SYSTEM'S FEATURES

Despite the limited scope and assumptions, the team has gone through an in-depth thought process to implement significant features in the recommender system which can substantially add value to potential users.

SYSTEM'S INTELLIGENCE & ROBUSTNESS

The BTO recommender system is very intelligent as it infers the users' preferences based on their input answer to the questions. They cover a range of factors such as finance, amenities and flat's characteristic and a detailed list is presented using the dependency diagram in Figure 2. Using the inferences as well as some hard limits, the system searches the database and provides a comprehensive solution. It recommends the users with a short and long list of HDB units. The short list consists of units which the system strongly recommends based on the users' preferences whereas the long list is a set of alternatives which the users can consider. In addition, in both lists, the system also provides the users with useful information such as price, room type, room direction, etc.

The system is also very robust. It utilizes certainty factors to prioritize the various needs (proximity to childcare center vs proximity to mrt) of the users and recommend them HDB units in order of importance or value to the users. This is only made possible with the adoption of the scoring matrix described in section 0 and formalized in equation (1). Proximity to amenities from units can then be quantified and evaluated by the system.

Lastly, the system's intelligence and robustness are demonstrated in Appendix A which presents three distinct test cases, simulating users with different requirements. The output results of these test cases are also available.

EASE OF ACCESS

The recommender system is built on a web-based application. Deployment of application is seamless, and it reaches to everyone. All users with internet connection can access the system using any devices such as a personal computer, mobile phones or tablets.

In addition, the interface is design to provide users with the best browsing experience. For instance, the display window is dynamic and adjusts to the type of devices which the users are using. Radio buttons were also employed to improve the ease of users' inputs.

SCALABILITY

The system is developed to benefit users of the present as well as the future. As BTO projects are launched every quarter of the year, the system is built with the capacity to scale to include all available projects as long as data is publicly available. This is because the team has adopted a web scrapping technique to retrieve information on BTO units from the HDB website.

In addition, as the selection of BTO units is an on-going process, there is a queue and not all users are fortunate to be first in line (Housing and Development Board, 2017). Hence, to benefit these users, our system has the capability to provide real-time update on the units' availability. All it needs to do is to increase the frequency of web scrapping.

4.5 LIMITATIONS

The entire decision process in purchasing a flat is complex as there is an umpteen number of factors to be considered. Despite the conduct of the survey as well as the consultation with the subject matter expert, it is inevitable that the system will fail to address the needs of the minorities. This group of people might assert on intangible factors such as geomancy, presence of religious sites or other unforeseen aspects. While these factors were not part of the decision matrix, it is certainly possible to consider them during further enhancement of the system to provide a more comprehensive result.

5.0 CONCLUSION & REFRENCES

Our team had a wonderful time working on this project, and definitely picked up useful skills along the way.

Knowledge gathering was a crucial part of the entire process. Without a sound knowledge base, we wouldn't have been able to build on system based on all the different rules. Our group now has a better understanding of the common methods used to build our knowledge base, and have employed 2 main methods in our project – namely interviewing a subject matter expert, and conducting a survey. Both had their merits. The interview with the expert enabled deeper insight into the topic, whereas we learnt the importance of modeling our survey questions carefully to patch any existing knowledge gaps and obtain a sense of how the general public perceives the problem.

Building the system itself presented a whole new set of learning points. We got to apply practical knowledge of the CLIPS system, as well as tap on our existing expertise in SQL, Python and data modeling. Working on the exercise together allowed everyone to learn technical skills from one another, which is an added benefit over doing individual work.

Overall, it was truly a multi-dimensional problem due to large number of factors involved and number of units available during each BTO project (4000+). Looking at the wide variety of topics that every group is working on, we have come to appreciate the usefulness of Rule-Based reasoning to solve everyday problems in a systematic manner.

5.1 IMPROVEMENTS:

If we had a longer time frame to work on this project, we would have worked upon the following points of improvement:

1) Compatibility for resale or even private housing

We chose to base our project on BTO due to the availability of data and popularity amongst our peers, but the reality is that Singapore's housing market is much more varied – it also comprises resale, Executive condo (EC), private housing or rental options. By adding compatibility for more types of housing, we would have been able to touch on a larger proportion of the property universe in Singapore.

2) Add in a certainty factor determiner in the initial stage of the algorithm

At present, the values used in the certainty factor are based on the survey results, which we have assumed to be representative of the public's sentiment. We can improve our system by customizing the certainty factor based on each person's unique preference at the initial stage of the CLIPS system.

3) Building our knowledge base

We recognize that most survey respondents are people from within our social circle – which explains the majority age group of 25-29. Our group could have further improved our survey results by polling a larger variety of respondents in terms of ethnicity, age group, and especially income brackets. The importance of building the knowledge base cannot be understated, as mentioned in our lecture notes:

"…the problem-solving power exhibited by an intelligent agent's performance is primarily the consequence of its knowledge base, and only secondarily a consequence of the inference method employed." – Edward Feigenbaum (Stanford University)

6.0 BIBLIOGRAPHY

Housing & Development Board. (2017, October 31). *Residential - HDB Flat*. Retrieved from Housing & Development Board: http://www.hdb.gov.sg/cs/infoweb/residential/buying-a-flat/new/hdb-flat

Housing & Development Board. (2018). *HDB's Sales Launch - November 2017*. Retrieved from Housing & Development Board: http://esales.hdb.gov.sg/hdbvsf/eampu12p.nsf/0/17NOVBTO_page_1918/$file/about0.html

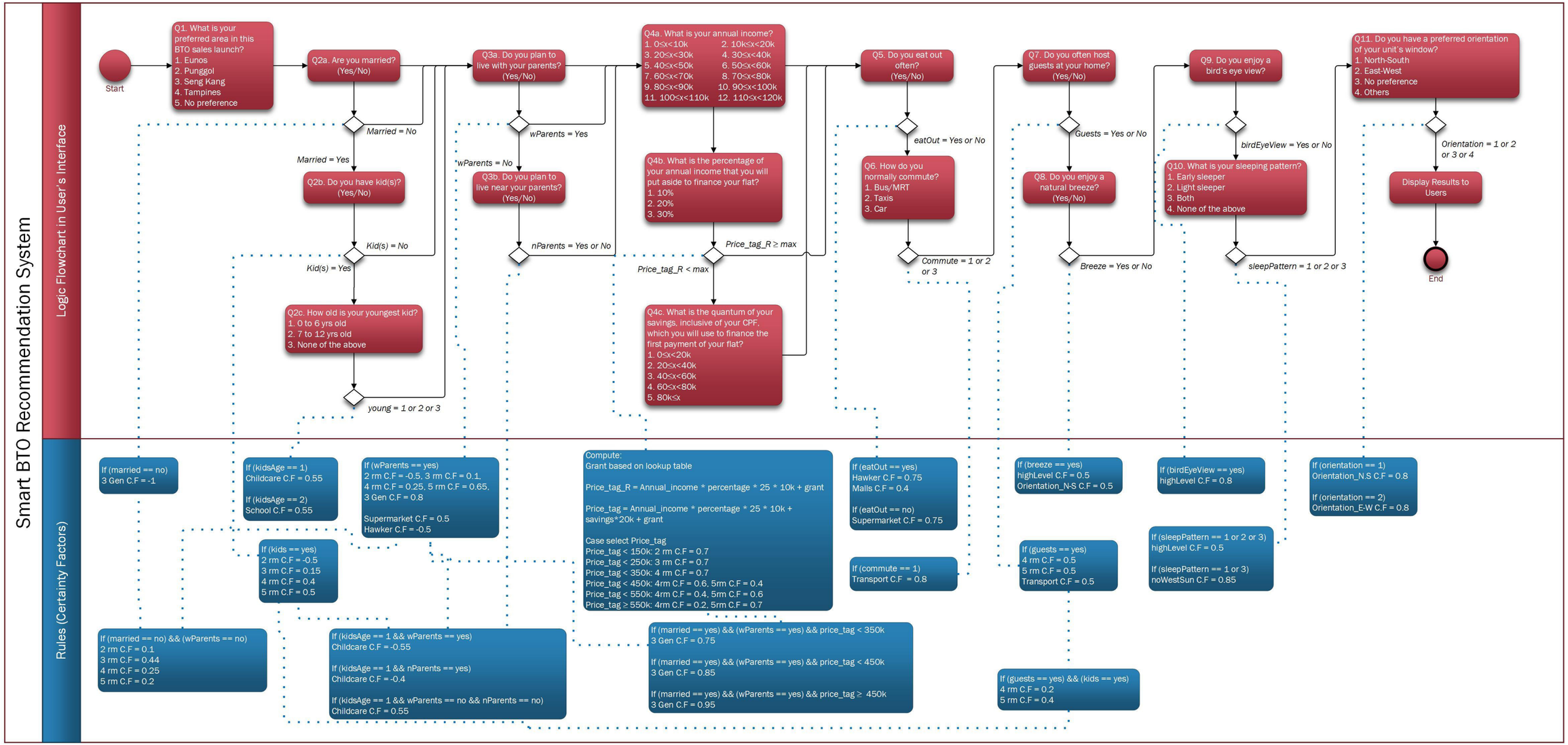
Housing and Development Board. (2017, October 31). *Residential - Timeline*. Retrieved from Housing and Development Board: http://www.hdb.gov.sg/cs/infoweb/residential/buying-a-flat/new/buying-process/timeline

Schreiber, G., Akkermans, H., Anjewierden, A., Wielinga, B. J., Hoog, R. D., Shadbolt, N., & Velde, W. V. (2001). *Knowledge Engineering and Management - The CommonKADS Methodology*. Cambridge, Massachusetts: The MIT Press.

APPENDIX A: SAMPLE INPUT & SYSTEM OUTPUT

In this section, the objective is to demonstrate the intelligence and robustness of the HDB BTO Recommender system. Considering rational needs of various potential home owners, three business test cases are developed and executed in the system so as to examine the output. Explained in section 3.2, certainty factors (C.F) to identify users' preference on specific features are built into the system. Every input from the users has an impact on the certainty factors which eventually influences the output. An outline of the system flow as well as the association with certainty factors is presented in Figure 6 below. The red section covers questions which users have to answer while the blue section associates the inputs from the questions to the certainty factors.

Smart BTO Recommendation System: Business Process Model & Data Flow



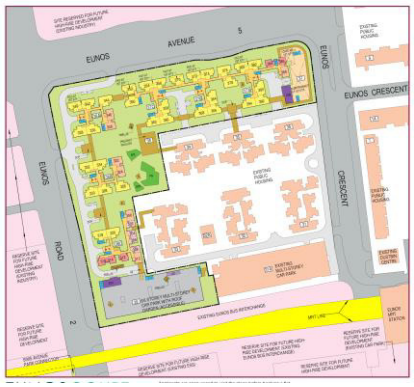
Legend:

- User's input
- UI Output/Qns
- Rules on Certainty Factors
- System Flow
- Association

Figure 6: Outline of System Flow

2.1 SCENARIO 1

<table>
<tr><td>Characteristic of user (Standard Case)</td><td>36 year old Unmarried individual (One-Person Household) employed in the Account industry with a monthly income of $8,200 and not intending to stay near the parents. He has a passion for cooking.</td></tr>
<tr><td>Questions:</td><td>1. What is your preferred are in this BTO sales launch? : Eunos
2. Are you married ? : No
3. Do you plan to live with your parents ? : No
4. Do you plan to live near your parents ? : No
5. What is your average monthly household income ? : $8,200
6. What is the percentage of your annual income that you will put aside to finance your flat ? : 20%
7. What is the quantum of your savings, inclusive of your CPF, which you will use to finance the first payment of your flat?: Between $40,000 and $60,000
8. Do you eat out often ? : No
9. How do you normally commute ? : Bus / MRT
10. Do you often host guests at your home ? : Yes
11. Do you enjoy a natural breeze ? : Yes
12. Do you enjoy a bird's eye view ? : Yes
13. What is your sleeping pattern ? : Early sleeper
14. Do you have a preferred orientation of your unit's windows? : E-W</td></tr>
<tr><td>System output (sample)</td><td>Our recommendations:
We recommend you a high level 5-room flat facing East/West near an MRT and a supermarket.
Here are the closest available units that fit your budget of $580,000
<table><tr><th>Project</th><th>Address</th><th>Block</th><th>Level</th><th>Unit</th><th>Price</th><th>Room Type</th><th>Direction</th><th>Floor Area</th></tr><tr><td>EUNOS COURT</td><td>EUNOS RD 2</td><td>37A</td><td>16</td><td>390</td><td>$578,824</td><td>4-room</td><td>E-W</td><td>93 Sqm</td></tr><tr><td>EUNOS COURT</td><td>EUNOS RD 2</td><td>37A</td><td>15</td><td>390</td><td>$574,765</td><td>4-room</td><td>E-W</td><td>93 Sqm</td></tr><tr><td>EUNOS COURT</td><td>EUNOS RD 2</td><td>37A</td><td>14</td><td>390</td><td>$570,706</td><td>4-room</td><td>E-W</td><td>93 Sqm</td></tr></table></td></tr>
<tr><td>Analysis of system output</td><td><table><tr><th>Features</th><th>Output</th><th>Explanation of system's output</th></tr><tr><td>Project</td><td>Eunos</td><td>This option was explicitly chosen by the user</td></tr><tr><td>Room size</td><td>5-Room</td><td>Based on user's input, the system has recommended a 5-room flat. However, since eunos project only has 2,3,4 room flats, the system has displayed 4-room flats as the next closest option</td></tr></table></td></tr>
</table>

Block	37 A	There are 6 blocks available in the Eunos project. Of the 6, the system has displayed block 37A due to its proximity to MRT (As expressed by the user while answering the questionnaire) With reference to the image on the right, it can be seen that 37A is the block that is closest to a supermarket and the MRT station 

2.2 SCENARIO 2

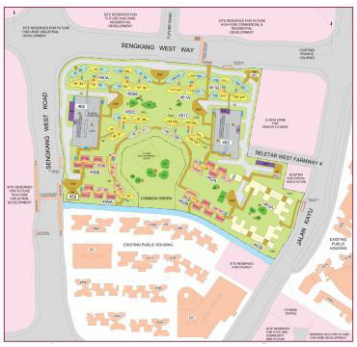
Characteristic of user (Challenging)	Newly married couple with a monthly household income of $7,500 intending to live near their parents.
Questions:	1. What is your preferred are in this BTO sales launch? : No preference 2. Are you married ? : Yes 3. Do you have kid(s) ?: Yes 4. How old is your youngest kid ?: 0-6 years old 5. Do you plan to live with your parents ? : No 6. Do you plan to live near your parents ? : No 7. What is your average monthly household income ? : $7,500 8. What is the percentage of your annual income that you will put aside to finance your flat ? : 20% 9. What is the quantum of your savings, inclusive of your CPF, which you will use to finance the first payment of your flat?: Between $20,000 and $40,000 10. Do you eat out often ? : Yes 11. How do you normally commute ? : Car 12. Do you often host guests at your home ? : No 13. Do you enjoy a natural breeze ? : Yes 14. Do you enjoy a bird's eye view ? : Yes 15. What is your sleeping pattern ? : Early and Light sleeper 16. Do you have a preferred orientation of your unit's windows? : No Preference

System output (sample)

Our recommendations:
We recommend you a high level 5-room flat facing North/South near childcare facilities and a hawker centre.
Here are the closest available units that fit your budget of $510,000

Project	Address	Block	Level	Unit	Price	Room Type	Direction
FERNVALE GLADES	SENGKANG WEST WAY	460A	14	77	$402,000	5-room	N-S
FERNVALE GLADES	SENGKANG WEST WAY	460B	14	103	$402,000	5-room	N-S
FERNVALE GLADES	SENGKANG WEST WAY	461B	14	133	$402,000	5-room	N-S

Analysis of system output

Features	Output	Explanation of system's output
Project	To specify	The system does not recommend him the project at Eunos unlike the first test case. This is because the user drives and need not stay near a MRT. Staying outside Eunos also give him greater options in terms of room size.
Room size	5 Room	The system has recommend a 5 room flat because the home owner(s) are able to afford it. They earn a reasonably high income and has substantial savings for the down-payment. In addition, they have a kid and therefore has a higher tendency to demand for larger room size.
Amenities/ Project	Child Care centre	The system recommends the user a flat near to a childcare centre. This is because the family has a young kid (0 to 6 years old) and do not stay near/with their parents. Hence, it is likely that the family lacks a caretaker for their kid and would require the service of a childcare center. With reference to the image on the right, it can be seen that Block 460A and 460B is nearer to the child care as compared to the other blocks. Also, Block 461B has been listed by the system even though its relatively further from the child care because 5-room units are not available in the other blocks. 

2.3 SCENARIO 3

<table>
<tr><td>Scenario (3)
(Standard Case)</td><td>A family of five (3G Household) with a total monthly income of $6,000 applying BTO for the first time.</td></tr>
<tr><td>Questions:</td><td>1. What is your preferred are in this BTO sales launch? : Sengkang
2. Are you married ? : Yes
3. Do you have kids ? : Yes
4. How old is your youngest kid ? : 0-6 years old
5. Do you plan to live with your parents ? : Yes
6. What is your average monthly household income ? : $6,000
7. What is the percentage of your annual income that you will put aside to finance your flat ? : 20%
8. What is the quantum of your savings, inclusive of your CPF, which you will use to finance the first payment of your flat?: Between $20,000 to $40,000
9. Do you eat out often ? : No
10. How do you normally commute ? : Bus
11. Do you often host guests at your home ? : No
12. Do you enjoy a natural breeze ? : No
13. Do you enjoy a bird's eye view ? : No
14. What is your sleeping pattern ? : Early
15. Do you have a preferred orientation of your unit's windows? : No Preference</td></tr>
<tr><td>Analysis of system output</td><td>Our recommendations:
We recommend you a medium level 3-Gen flat near a supermarket and an MRT.
Here are the closest available units that fit your budget of $435,000

<table>
<tr><th>Project</th><th>Address</th><th>Block</th><th>Level</th><th>Unit</th><th>Price</th><th>Room Type</th><th>Direction</th></tr>
<tr><td>FERNVALE GLADES</td><td>SENGKANG WEST WAY</td><td>460C</td><td>12</td><td>73</td><td>$401,500</td><td>3-Gen</td><td>N-S</td></tr>
<tr><td>FERNVALE GLADES</td><td>SENGKANG WEST WAY</td><td>460C</td><td>10</td><td>71</td><td>$395,000</td><td>3-Gen</td><td>N-S</td></tr>
<tr><td>FERNVALE GLADES</td><td>SENGKANG WEST WAY</td><td>460C</td><td>10</td><td>73</td><td>$395,000</td><td>3-Gen</td><td>N-S</td></tr>
</table></td></tr>
<tr><td>Analysis of system output</td><td>
<table>
<tr><th>Features</th><th>Output</th><th>Explanation of system's output</th></tr>
<tr><td>Level</td><td>Medium</td><td>The system has recommended a medium level flat because the user is not particularly fond of natural breeze or a bird's eye view. In addition, based on the stated Income and family size, the user will only be able to afford a Medium level 3-Gen flat.</td></tr>
<tr><td>Room-Type</td><td>3-Gen</td><td>The system has recommended a 3-Gen flat because the user has a family of at least 5 members (Based on the input provided)</td></tr>
</table></td></tr>
</table>

APPENDIX B: USERS MANUAL

BTO Recommender System

User's Manual

REQUIREMENTS:

RECOMMENDED BROWSERS

BTO Recommender system supports the following Web Browsers::

- Internet Explorer 11
- Microsoft Edge 39 and above
- Firefox 53 and 52 ESR and above
- Google Chrome Version 59 and above
- Safari Version 10 and above

SYSTEM OVERVIEW

Our HDB BTO Recommender system is a Web information system, which is generally targeted at young Singaporean couples looking to purchase their first property and set up a family. The website will ask a series of question, and generate the most appropriate HDB unit that fits the user requirements.

USER INTERFACE

Our user interface runs in Python. Once our inference engine outputs the result, the result would be sent to python which then queries the most appropriate HDB unit from the database, and displays the results onto the web interface.

DEPLOYMENT

Our System is deployed in an Ubuntu server 16.04.4. In order to run the system, you will need to have a working Python installation with the necessary libraries installed:

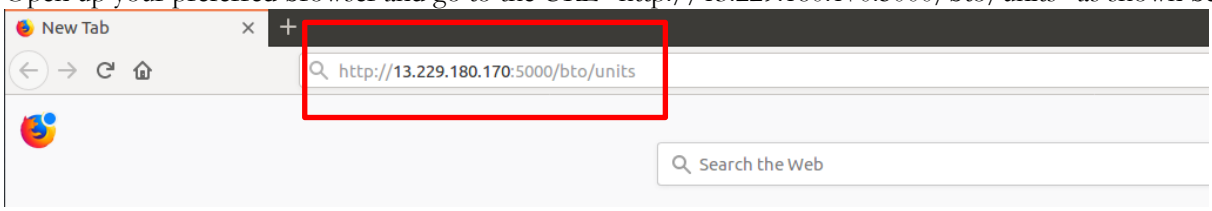
- python-clips (install using apt-get)
- flask
- flask-socketio
- eventlet
- simplejson
- panda

To install the libraries above, key in the command “pip install <library’s name>”.
To run our system, simply open a terminal, enter:

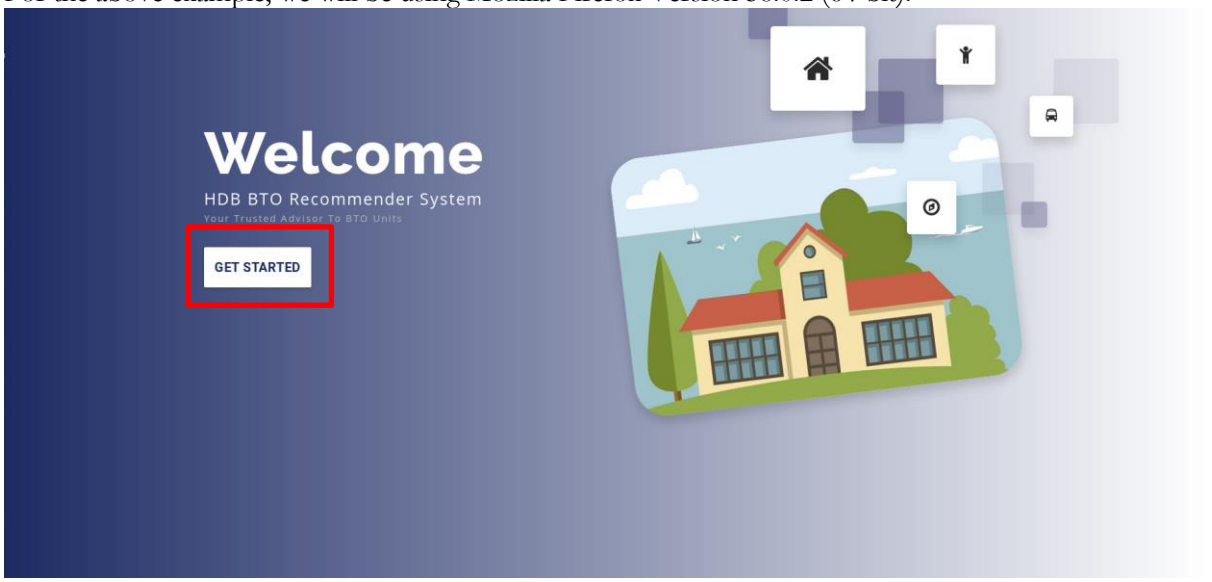
- cd <path of the system>/bto-recommender-system/clips
- python app.py

START

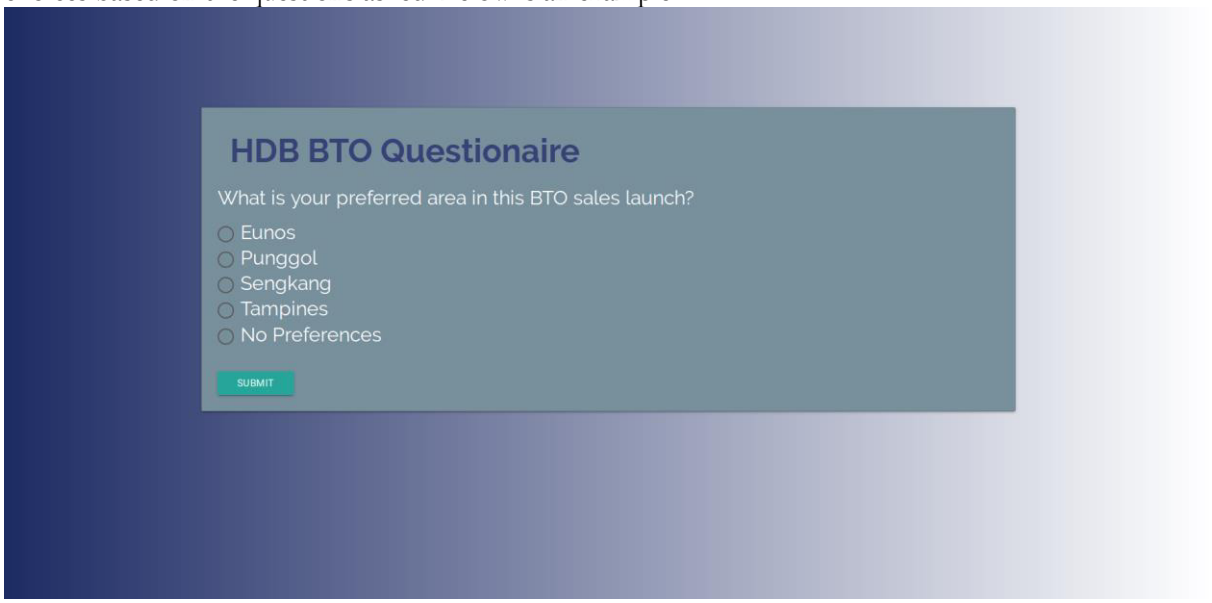
Open up your preferred browser and go to the URL "http://13.229.180.170:5000/bto/units" as shown below:



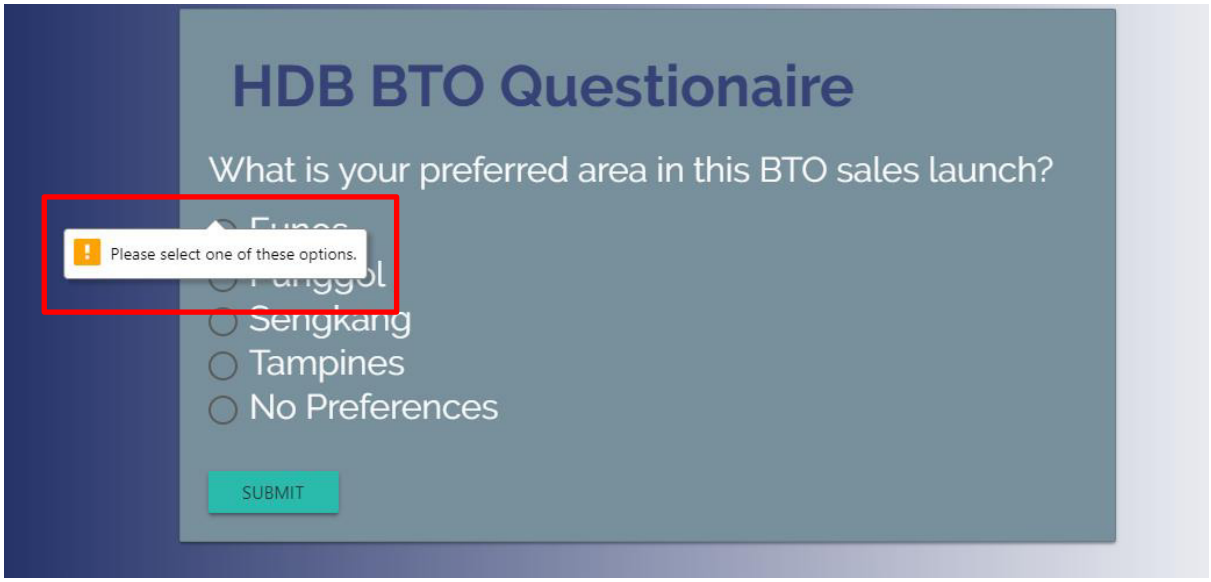
For the above example, we will be using Mozilla Firefox Version 58.0.2 (64-bit).



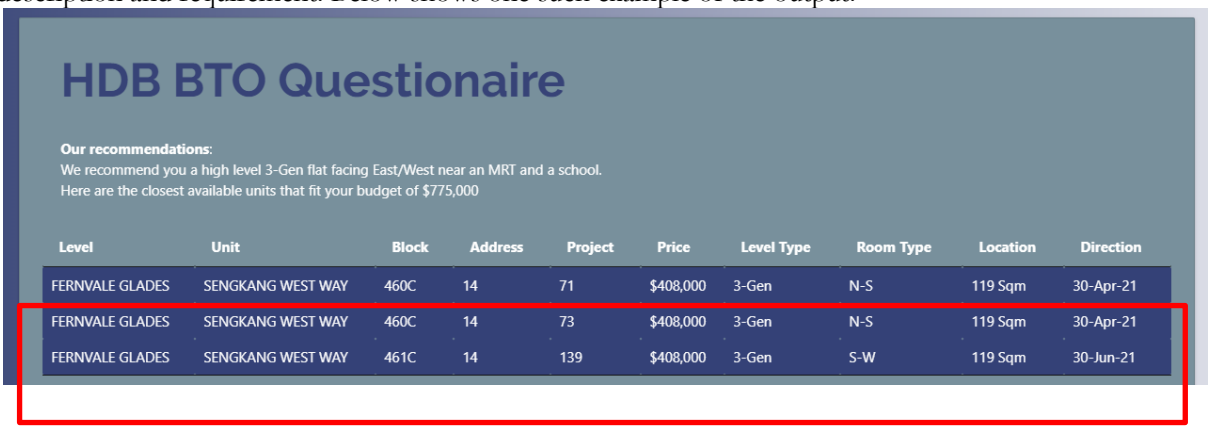
Click on the GET STARTED button. This will lead to the questionnaire session where users would select their choices based on the questions asked. Below is an example:



To proceed onto the next question, users are required to select one of the given options. If no input is selected, a prompt will appear to tell the user to select one of the options shown below:

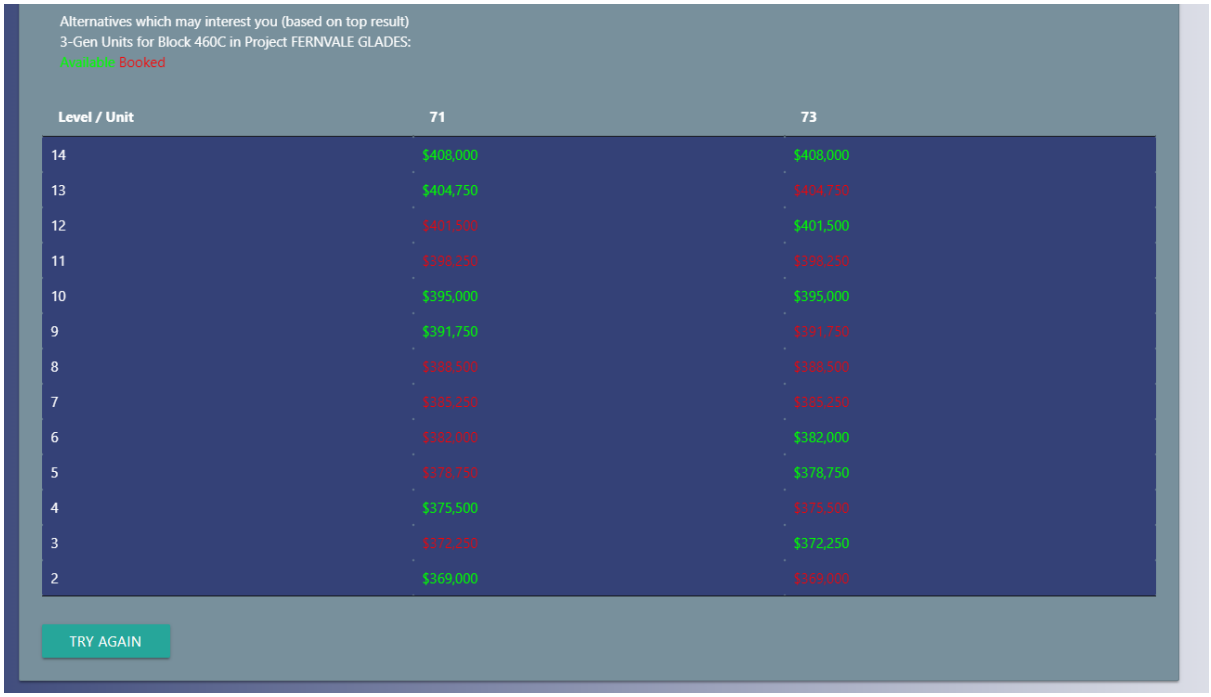


The user will answer approximately 12 questions. After all the questions have been asked, our system will gather all the facts. Using our inference engine, the system will then output the top 3 BTO-units that best fit the user's description and requirement. Below shows one such example of the output:

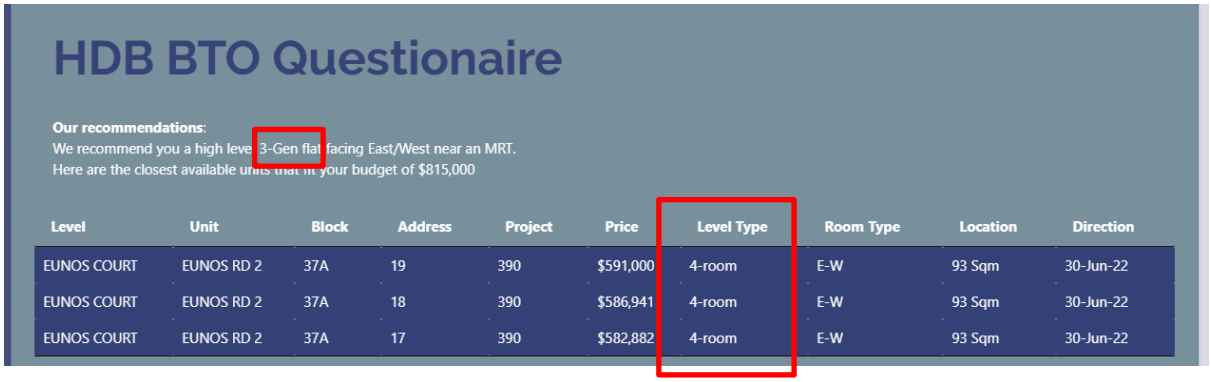


Level	Unit	Block	Address	Project	Price	Level Type	Room Type	Location	Direction
FERNVALE GLADES	SENGKANG WEST WAY	460C	14	71	$408,000	3-Gen	N-S	119 Sqm	30-Apr-21
FERNVALE GLADES	SENGKANG WEST WAY	460C	14	73	$408,000	3-Gen	N-S	119 Sqm	30-Apr-21
FERNVALE GLADES	SENGKANG WEST WAY	461C	14	139	$408,000	3-Gen	S-W	119 Sqm	30-Jun-21

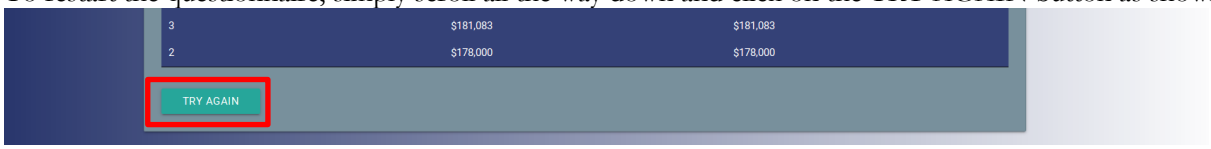
The bottom portion of the page shows the listed price of the units that are on neighbouring floors of the one recommended by the system. Green indicate that the room is available to purchase, while red would mean the unit has already brought by someone else.



As there will be cases whereby the best recommended unit is not available, for example if the particular unit is already booked or the particular project does not have such a room type, our system will then output the next best alternatives. One such case is shown below:



To restart the questionnaire, simply scroll all the way down and click on the TRY AGAIN button as shown below:



APPENDIX C: INTERVIEW LINKS & TRANSCRIPT

Due to the large file size of our interview video file (~3GB), we provide only the link to obtain the audio and video files.

AUDIO FILE

https://drive.google.com/open?id=1RAtursE4fMJqxn1c-abPR2yiej0UvOtK

VIDEO FILE

4 parts

1 https://drive.google.com/open?id=1wOvftS8gOMtk0de-siQYpIK-RRuBiI20
2 https://drive.google.com/open?id=1oY9IYClcs_evT1mL5CLwFwh8QTI8hI60
3 https://drive.google.com/open?id=1cMMMHXPF5Q5BEExVivLbhTrVNnEjgUrz
4 https://drive.google.com/open?id=1qmKDiDXh7Ni92OH2WcJM6hvkEUAI593t

INTERVIEW TRANSCRIPT

JW: Today we would like to thank Jay for attending the interview. In this interview we try to understand the decision-making process of the generic population behind choosing the BTO flats

Jay: First of all, thanks for having me here. Firstly, a short introduction about my self. My name is Jay I am a Real Estate agent. I have been in the industry for about 4 years focusing mainly on the residential properties particularly HDB flats in nature.

JW: I will start off with some generic questions. So for BTO flats who do you think are the target audience?

Jay: okay for BTO flats itself it mainly falls into two categories. First timer and second timers. First timers refer to people who haven't gotten subsidised housing before. Second timer means that people who are getting their second time flat who has previously gotten a flat.
For first timer itself usually they are probably like young couple who just got married and they are looking for first purchase of their flats. For second timers, it will probably be the people who are in their 40s and who have previously gotten a subsidized housing and are looking to get a new house as well. The reason why people get BTO flats is very simple. Most of them have the idea that BTO flats are cheaper and they see it as a way whereby they can make money selling off their BTO flats after 5 years. That's the main reason why people go for BTO flats. Second main reason is because BTO flat is a new flat. So, people like the idea of new you know. They just completed the property and they are the first one to get the property. These are the main two reasons why people want to buy BTO flats

JW: Alright sure. So, let's say if I were to choose a BTO flat, what do you think are my TOP 5 considerations?

Jay: Usually for TOP 5 considerations, the first one of course; I wouldn't rank them in order, but I would say that all these factors are important in terms of decision making process.

1. This is location. Because people are usually may be very familiar with a particular area or may be because they want to stay near their parents or may be because there is a particular school that they want their kids to get into. It's just like if you are very used to staying in the east, most likely you wouldn't want to go and shift to the west area because you are not familiar with it.
2. With location comes the price. Because mature estates itself the price of the properties actually are higher compared to urban areas Sengkang Punggol area, Tampines, Yishun Woodlands area. Bukit Merah, Queenstown are usually the more popular area because its mature estate and very near The Central location. Of course, this area itself is pricier. So, I would say that usually these are the two main important factors that people consider
3. Other factors include things like the date whereby the BTO is launched because people plan for their marriage and when do they want to collect the key for their flat. Sometimes it's really because there is no

other choices available out in the market and they really need a place so they have to decide okay which is the best place possible that they can actually go for.

4. Other facts are more personal. Maybe they want to stay near the parents because it's easier for them to go back to the parent's place. If they have kids in the future their parents can come back and take care of the kids. I would say that mainly these are the two factors that people decide.

JW: From what I see, location seems to be a really important factor. So, you have been in the industry for 4 years. Do you know of any factors that are actually commonly overlooked by people? Like some important considerations that people usually did not realise until they move into the house.

Jay: The thing about BTO is that you actually off hand you don't actually see the physical unit. What happens is that you see a model whereby HDB will actually construct a model and you just see everything based on the floor plan. So, the thing is for most people you can't really foresee what's going to happen because you don't know exactly what's going to be in front of the unit or when you actually look out from the unit. How is it actually going to be you know? All you are buying from is from a piece of floor plan and a model. So, I would say that most people usually they don't know what to look out for actually it's very difficult to do. The only thing that you probably can look at what would be the floor level and in terms of the facing based on NSEW. These are the main things that people will be able to look at.

JW: So, I guess they are very limited information when choosing the BTO. So, have you heard of any regrets after people have moved into their flats?

Jay: I think people who regrets are those who opt for lower floor level. Because the things about the lower floor level unit is usually difficult to see. For Chinese, most people are getting the higher floors because one thing is maybe they are used to staying in higher floors units. Low floor units tend to be darker and higher floor units usually are winder. And usually the views are nice as well. That is why people usually prefer higher floors compared to lower ones. Maybe the second is that the facing of the unit like people don't think about west side unit until maybe they got the unit and they realised how hot is it for west side unit. So mainly is the west sun and the lower level.

JW: So, we move on, moving into the affordability part of it right, how would you advice individual or families to choose their BTO flats based on their household income?

Jay: Based on the HDB policies right now right I think its pretty affordable, what do I mean by that right because there is this thing called the mortgage service ratio which is capped at the 30%. Which means to say that let's say you are earning an income of $10000, you can only use up to $3000 to service the mortgage. In a way, HDB has tried to make it affordable by ensuring that they do not overstretch. That's the first thing. The second thing is that HDB itself right, before you actually purchase a HDB you actually need to take a loan. The load itself is based on your income. So, based on that the loan and looking at how much CPF you have as an individual / couple you will be able to roughly identify what is the affordability. Most people in today's market right are very savvy. More or less they actually know what their affordability level is. So most of them wouldn't over stretch. Plus based on the HDB Policies itself they ensure that people do not overstretch. But I would say that people that go for two room flats, three room flats usually are singles or maybe they are older age group people that actually go for such flats because they are going to retire. For young families they actually go for 4 room flat. Or May be a 5 room flat for those who have children and parents staying together. Maybe they will even go for multi-generation flat. Multi-generation is a new concept introduced whereby we have three generations staying together.

JW: So, it has a bigger floor area?

Jay: Yes. It has bigger floor area and more rooms. Something like our current executive apartment.

JW: I also understand that if we purchase HDB flats, there are also an array of grants that you can get? So, do you think this grant has actually affected people's choice of flat? Or it's just an additional bonus?

Jay: Yes, it have definitely affected the choice of flats. If you look at the grants, its directed in a way to entice people to go the re-sale market rather than the BTO. Because if you look at the proximity housing grant right now; it's at $20000. On top of that if you are a first timer buying a 4-room flat, assuming that your income does not exceed

$12000 you can actually get $50000. So, $50000 and $20000 its actually $70000 of grant that you can get not including the additional housing grants. So, for normal Singaporeans, if I am going to stay near my parents and I am earning below a combined income of $12000 and buy a 4-room flat, I can get the $70000 grant. Let's take an example, let's take punggol, there are certain areas where the flats reached 5 years and just right next to it there are flats that are actually launched by HDB but sales of balance flat which were not sold previously. If I were to compare their prices, as a buyer I will actually consider a resale flat. Assuming that I can take the $70000 grant it becomes way cheaper.

JW: The $7000 is only applicable for re-sale?

Jay: Yes. Because for BTO you are not entitled for the $70000 grant. And for BTO, the price is already subsidised. But for the resale, the $50000 we can deduct off the price of the flat. So, if I were to give you an example, a flat in punggol, the SOB flat 4 room costs about $370k in comparison a resale flat cost 420k for newly 5 years flat. So, if you compare, if I were to purchase the 420k flat and I were to get a grant $70k. I will be purchasing it at $350k. IF I were to get a BTO @ 370k not factoring my renovation cost probably like 30-40k. it will add up to $420k which means that I am actually purchasing the resale flat at a much lower price.

JW: Actually, just now we touched a little bit on the 4-room and 5-room. I believe they are also priced differently. So, would you advice people to go for 4/5 room?

Jay: I would say that it really depends on your needs right. We can't just totally look at it from the price point of view. In terms of public housing, it really caters to the need of family rather than as an investment. For needs itself it really depends on the family size. And I will say that people were to go for 5 room because they feel that they will be needing the space. If people were to go to 4 room they probably feel that I don't need such a big space, but I think the price at this point price range itself it's something that I am more comfortable. Every family the household is different. So, each household itself they will probably have their own sets of needs that steer them towards their choices

JW: What stands out in a 5-room flat?

Jay: What stands out in a fight room flat comparison to a four-room flat, the difference between that is just size. What stands out between a five-room flat and a four-room flat is that actually the master/ living Hall is slightly bigger for 5 room compared to a 4-room flat.

JW: At the start of the interview we actually identified location as one of the important consideration. What do you think the top 5 amenities that people actually look out for?

Jay: okay I think that if possible people actually go for a flat that is near the MRT and that's the first thing. Second thing is that they usually go for shopping malls. The third would be wet markets and the fourth one is actually schools. I name this not in order of importance.

JW: Schools would be primary schools is it?

Jay: Usually primary schools or sometimes even secondary schools but I will say mainly primary schools.

JW: Other than the specific neighborhood or location you mentioned that for floor levels right Chinese actually prefer higher levels. Is it just a perception?

Jay: No it's not a perception. okay usually lower levels are preferred by Malays. i.e. 1st floor 2nd floor 3rd floor and Chinese do usually prefer higher floor levels

JW: Do you know what are the reasons for choosing lower floor levels?

Jay: It is got to do with their culture right. Last time in in the past is like kumpong. So for kumpong itself, yeah they are used to ground floor levels; they like the ground floor levels because it resembles the kumpong and I believe the second reason is probably maybe got to do with the wake or the funeral. I think for Malays, when they pass on they actually bring the body back to the house so imagine if they were like taking the top floor you can't take the lift so you

have to take the stairs. While I would say that this is a second reason I would say the primary reason is because they are more used to staying in like lower levels

JW: Why do Chinese people actually choose higher floors?

Jay: Yeah because as Chinese usually prefer brighter houses we prefer like windy houses but I think it's more like they are used to it because all along they had been staying in high-floor units and suddenly when you go into something, the feel is very different when I'm looking up I'm looking at the trees instead of looking at the sky; They are just not used to it.

JW: Do you have like a definition / classification of the floor units?

Jay: Usually for Chinese / most people are okay with mid-to-high flow units. Mid-floor units usually starts from 5th floor. Flats itself people are really concerned about cockroaches issues for the older flight itself so if you're in the lower floor itself cockroaches will be an issue so they will prefer higher flow. Newer HDB flats nowadays doesn't really have this issue because of the centralized rubbish chute. The older flats the chutes are is inside the house. I will say that nowadays the pest issues are not really a concern. Its only there for older flats.

JW: So, moving on from floors right, if we go into units, just not earlier you mentioned that some of the people regret having their units facing the so called the direction that they do not want. So, what are the generic / directions that people actually go for?

Jay: First of all, for house that are facing North-South direction. This is the windiest direction. Half yearly it will come from North direction and half yearly it will come from south direction. So, units that are actually East-West facing probably wouldn't have much wind. Especially the west facing units will have the west sun. So, the house will be really hot. So these are for people who are actually not really concerned about fengshui and all that.

JW: So what are the examples of the layout of the unit that has actually got to do with feng shui.?

Jay: Actually it really depends. I would say that when we talk about Chinese fengshui and Indian fengshui are totally different and they look at different things also. So, for fengshui itself its really difficult because sometime they look at the kitchen facing, sometimes they look at the door facing and they look at the living hall facing to see if it all tallies with fengshui.

JW: Is there a generic good luck layout of the unit? or there isn't?

Jay: Usually people will prefer some that is more squarish rather than something that is odd shape. Not just because of fengshui but also because its easier to place the furnitures. So I would say that that is the more important reason why choose a squarish layout.

JW: Personally, do you recommend any specific kind of layout?

Jay : okay, nowadays the layout is actually very standard for HDB. Regardless of which area, Nowadays its very similar to the condo layout already. Whereby the flats are all corner units; you no longer see corridor units flats. And usually the common room toilet is out the bedroom itself. And the kitchen nowadays comes with a yard area. So pretty much nowadays the layout is standard already. So, I will say that for people who are looking at feng shui; The thing about fengshui is that it can always be changed? I wouldn't say something that is perfect. Usually people will be more concerned about things like the unit number and the Door facing. Other things like unit layout let's say it doesn't match, people can still do some alterations to it. So, I would say that inside the house itself people are not so concerned.

JW: Oh, Unit number for people who are more particular about?

Jay: I think its particularly for Hindus/Indians they are into like numerology or something like that. So, they will actually count as to how much does the unit number actually add up to. So, for them like the unit number actually plays a part. And for Indians, a lot of Indians, they like the door to be north-east facing. To them north-east is a good

direction. Most of the Indians that come to me ask for doors that are north-east facing. 90% of them ask for north-east facing.

JW: Oh Okay. So just now you talked about North-south facing for the wind and East-west facing for the sun. This actually refers to the where the windows are usually facing is it ?

Jay: Yes, living hall or your bed room window.

JW: Oh okay, that's how the wind comes in. So just now we also covered that you know HDB's units has been progressing / changing over time. I have also learnt that there are some smart HDB for eco-friendly / green HDB that's coming up in Puggol. So, do you think these are favoured over the predecessors?

Jay: Oh yes. Nowadays the buying trend of regardless of private condo or HDB, the trend has gone towards new. People want new. So, if you were to compare two blocks of property side by side right; with one 5 years and the other 30 years old. Probably the 30 years one might be bigger. But I would say that most young couples today they rather go for something that is new rather than for the size. First thing is they don't need to do renovation which they can save a bit of cost on it. Second thing is that they really want new. Because when they walk into a 30-year-old flat and 5 years flat, everything is totally different. We notice that nowadays the buying trend has been going towards new. Right now, this smart home concept is something that is very new. So not only are we seeing this smart concept in the private housing but also in HBD. Flats nowadays are moving towards that direction. And people tend to choose this over the older flat because its something that's new and people like new. Looking forward, I would say that this is something that people will be looking out for. The new flats in the future might all be smart flats.

JW: I think I have pretty much come towards the end, so before we actually end-off , do you have any advice/ recommendation for young individuals / families who are going to choose their flat?

Jay : Okay. I think the reason why people end up choosing and regretting choosing the wrong unit is because of the hype. When they actually so called decide to go for a particular BTO project right; like a popular one like let's say Bidadari right. It was oversubscribed by many many times. So the thing is under such situation where by you see so many people trying to get a flat, even if you get a lousy unit you will still go for it because, if you don't go for it someone else will just take it. So, during that period of time, you just think that okay am lucky enough to just get it. So even if it's a second floor unit, I will still get it right. Its still better than never. So, it's the emotions that comes in when you actually choose a unit, the fear of missing out you know. That actually causes people to make a bad decision. Going for something that is not a preferred choice because other units being taken up. So its usually under this kind of circumstances that you end up taking a bad decisions and especially for BTO itself ,the thing is you never know what is going to come up for fact. Like when we talk about a house, inside a house we can always make renovation and adjustments to inside the house. But, things that are out side the house you can never change like if there is going to be a tree in front of the house / a temple / mosque in front of the place; usually people dislike because its noisy you know. So I would say that in todays market right, its unlike past 5/10 years ago whereby a lot of people buy BTO as an investment. Its true, those people who probably bought the flats 5 years ago, and they are selling it today, they will most likely probably make $100000 on average. But that's not true for people who are buying flats today because, HDB actually matched the BTO prices to resale market. So, its no longer the days whereby you buy a BTO and you expect to make $150000 after 5 years. So, from an investment point of view, I don't see that anymore, so I would say that with the grants favouring the resale market, probably it might be a wiser choice to go for a re-sale market because you don't have to wait for the three years.

Jay: What I feel is that for BTO, they already know what they want. Like let's say I'm staying in Bedok

YC: So instead of calling it BTO we call it young couples buying their first house. Should they go for HDB or should they go for resale.

Jay: But if I do it, I will probably include private as well. Because it's easier for me to compare. You should make it maybe young couples buying their first flat – should they go for BTO, resale, or should they go for private. But of course that's a bigger scope, but it's easier to compare. Because BTO everything is, there's not much variable. It's very standardized.

YH: But it seems like resale and BTO the price are pretty much similar.

Jay: Now in today's market if you are entitled to the grants actually resale is cheaper.
YH: Then private will be a lot more expensive, for example condo

Jay: Condo in comparison, usually. For HDB estates, 4 room is 400+k. Condo then would be 800+ for 2 bedroom. For HDB and private we name it differently. HDB we call it 2 room flat, 3 room flat, 5 room flat. But for HDB 4 and 5 room flat they have 3 rooms. But for condominiums, we don't call it the same. We call it 2 bedder, means there are 2 rooms. 3 bedder means there are 3 rooms. So terms for HDB and private are different. For 4 room flat it is in comparison with private, 4 room flat is also 3 bedroom. About 400-500k. For 2 bedroom it is maybe 800. 3 bedder will be around 1 million.

JW: Just now you brought up one example about Punggol, BTO is about 300. Sales of balance is about 370k. Resale one will be about 420. How about an equivalent size condominium.

Jay: Equivalent size of condominium will be about 3 bedder size. A 4 room flat is about 90-92 sq m. So its about 1000 sq feet. In todays context is about a 3 bedder size. It will cost about a million, about double compared to HDB. But I feel the main comparisons will be location, things like price. The algorithm you are creating – location, then maybe price. Age of the property. Age is very important. Partly because older age, once it reaches a certain age, your loan and CPF will be affected. The lease. Just that nowadays people are moving towards new. You can see a huge disparity, like in Punggol itself the difference between a 5 year and 15 year flat, the price range can be a lot.
So for similar 4 room and 4 room flat, the range is very big. For 4 room flat it can range all the way from 350k to 500k. That's a 200k difference just purely based on 4 room flat. The main 2 things are location and age of the flat. Because the 550k one is nearer to MRT and is newer, 5 years.

JW: But the 5 year and 15 year doesn't really make a difference, or do they?

Jay: It does make a difference, in terms of the building itself you can tell which is 5 years and 15 years. Firstly is the layout. The layout is totally different for the 5 years and now. And for a 5 years flat, usually is a move in condition. You don't need to do renovation for the new buyer. But the 15 year old flat its as good as a full renovation. So people normally just rather shift into the house rather than move into the flat and have to do renovation. And this has to do with affordability as well. Why? Because Its like when you are doing renovation you need to pay cash. So let's say we buy a 500k move in condition flat, I don't need to do any renovation. If I take HDB loan I can take up to 90% loan, and the 10% I can finance with CPF. Which means I have minimal cash up front. But if I buy a 400-450k flat and need a 50k renovation, this 50k renovation I need to come up in cash. I'm not covered by the loan and the CPF. For a lot of people this is affordability because they need to come up with the cash. They rather use the CPF. So that's the difference why people rather go for new flat rather than old flats.
I think another very important thing is talking about demographics. Understanding the people who are staying within the estate. Because for Punggol itself, majority of population itself are young couples. For young couples, nowadays we have a smaller family size. So you can see Punggol majority are 4 room flats. 3 and 5 room are very little. Because a lot of them are young couples. How government build the flats is they cater to the demand also. So they realise that nowadays for people they have smaller and smaller families. So 4 room flat will be more comfortable. You also see they give more grants to people who buy 4 room rather than 5 room flats.

JW: Actually are there grants for 5 room flat?

Jay: Yeah there are. They still have grants, just that you get 10k more if you get 4 room flat. 4 room you get 50k, 5 room you get 40k. So how does demographics contribute to how people decide. Next time if I want to sell, I want to know if I can sell my flat easily. So for example today Punggol itself, 4 room flats are abundance. Meaning there is a lot of supply. So 4 room flats are harder to sell. 5 room flats although they are more expensive it is easier to sell compared to 4 room flats. So if for me I know this is the situation, I will go for the 5 room flat because it is easier to sell. But there is a lot of competition if I want to sell the 4 room flat. So understanding the population and demographics is very important. So if let's say right now I have 2 choices – I have a choice of either Punggol or a mature estate. I might actually get a 5 room in Punggol but if I go for mature estate I might go for 4 room or 3 room. Because for 5 room for Punggol it might be easier to sell. Secondly in mature estate, it is because of affordability

issues. For mature estates the 5room can go up to 900k. And if I as a buyer I can buy a 900k or 1m HDB flat, it means I can easily afford 2m condominium. So actually my income is actually quite high, so I have more choices. So the profile of people who buy a 900k or 1m HDB is very rare. If you were to ask a young couple – would you rather buy a 900k HDB in a mature estate or you rather buy a 900k condo in a not so convenient estate. I think most people would rather go for the condo. That's the reason why if you were to go for a very expensive HDB, it may not be easy to resell. Has to do with affordability. And if people want to go for the flat that range, they may not be able to go for it because their budget is 500-600k. SO the 800k is out of their range. And the people who can afford it, they have a lot of choices. So it becomes neither here nor there. So I would say if I were to buy a flat, I would also understand the demographic or profile of people who purchase them. Or things like certain areas there may be more Indians. Certain areas may have more Malays or Chinese. For example in East Geylang there may be a lot of Malays. Because over there if you understand the area, there are a lot of Malays. In Sengkang and Punggol nowadays, there are having a lot of Indians. Indian PR buyers also. If you understand the people buying, you can make a better judgment as to which is better depending on your plan. As for mature estates itself, Bukit Merah Queenstown, a lot of them may be young people. Yah I would say quite a fair bit are young couples purchasing those newer and more expensive ones. Because older people they can't afford due to loan tenure. So if you understand the demographics I would say that is very important if you want to come up with the algorithm. Age demographics.

Schools also very important. Why schools. Do you all know Rosyth. Rosyth is in Serangoon North now. But before they shifted they were in a landed area. SO if you compare Serangoon North and Serangoon Central, they are the same price. It shouldn't be the case. Serangoon central is supposed to be the expensive one. So last time Serangoon central used to be a lot more expensive because Serangoon north nobody wants. But when Rosyth shifted there, immediately the price shoot up to be same as Serangoon central. You see Bishan why is it so expensive, it used to be a cemetery. But Bishan has all the good schools there. RI, Cat High, all the schools are there. That's why Bishan is so expensive because of the schools. Talking about that, you all need to remain these 3 important things. These 3 are the reasons why people would shift house. It would fall under these categories.
First is people shift house to make money. Cash out, investments. This is the first one.
Second one is they shift house to stay nearer to their parents or kids. Third one would be work. The work one not so important, first two are more important. For investment cash out. Second one is stay near parents or kids. So if you all can come up with algorithm with where are the good schools, but that's why I say it's very difficult to compare.

POST INTERVIEW QUESTIONS

On Thu, Feb 22, 2018 at 11:40 PM, yuchen <gohyuchen@gmail.com> wrote:

Hi Jay,

Thanks so much for having the interview with us the other day. Our group has a few follow-up questions that we thought of after the last session and hope that you could address them.

1) Since price is a big part of the decision, what is the typical size of flat that people tend to purchase say, if they were willing to spend more than 550k? What about 350k?
2) Would a person's sleeping patterns affect his decisions? Our group believes that this may drive them to purchase a higher floor as it is quieter
3) How often do people go for multi-gen flats? Is it a popular idea that is catching on?

Hope to hear back soon, thanks!

--
Best Regards,

Goh Yu Chen (Mr.)

On Fri, Feb 23, 2018 at 19:28 PM, Jay Xie <enquiries@jay-xie.com> wrote:

Hey yuchen,

You can refer to my replies below in green. Feel free to reach out to me if you have any further questions.

1) Since price is a big part of the decision, what is the typical size of flat that people tend to purchase say, if they were willing to spend more than 550k? What about 350k?

I would say that of the customers I have dealt with, about 70% of them who have a high budget of 550k will go for the largest possible 5 room flat. Those between 350 to 550k will probably be split between 4 and 5 room flats in a 6:4 ratio. Of course, these are just rough estimates because everyone has different preferences. I have also seen people with very high income and budgets go for a smaller flat because they don't need such a large space.

2) Would a person's sleeping patterns affect his decisions? Our group believes that this may drive them to purchase a higher floor as it is quieter
This is one of the fine areas that people usually don't consider. Yes, it definitely has an impact on their purchase. People who tend to sleep early or are light sleepers prefer a higher floor because it is quieter from the traffic near the ground. Some people may say that it is a consequence of people simply preferring higher floors in general, but I have received queries from clients who are worried about the noise level at lower floors.

3) How often do people go for multi-gen flats? Is it a popular idea that is catching on?

Yes definitely. This is especially true for people who plan on living with their parents. Not only is the flat size larger, there are also priority schemes targeted at this group. I think that with people generally living longer and due to space constraints in Singapore, this will become more common in the future.

On Fri, Feb 23, 2018 at 11:49 PM, yuchen <gohyuchen@gmail.com> wrote:

> Hi Jay,
>
> Thanks for the reply! We will take your inputs into consideration and perhaps let you try out the system when it is complete.
>
> Best regards,
> Yu Chen.