# 



# School of InfoComm Technology

**Data Discovery & Visualization**

October 2021 Semester

**ASSIGNMENT 1**

**(Individual Assignment)**

**Submission Deadline:**

**19 Dec 2021 2359hr**

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| --- | --- | --- |
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**Penalty for late submission:**

10% of the marks will be deducted every calendar day after the deadline.

**NO** submission will be accepted after 24 Dec 2021 12:00 Noon

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# 1. Background Information

A typical Singaporean citizen can be both a flat buyer and a flat seller. Therefore, I will be splitting my reasons into the ones for the buyer and seller.

Some factors that a typical Singaporean will care about will be listed below. All these factors can also affect the price of a flat, which a Singaporean will care about as it directly impacts if they, as a buyer, can even afford to buy the flat or, as a seller, sell their flat with a price high enough that they do not make loses, and low enough that their price does not seems unreasonable.

When buying a flat, most Singaporeans would already have a combination of their preferred a flat type, flat model, town, storey range and block in mind. The graphs generated below would be for buyers who already have these in mind. For those who do not already have these in mind, the graphs can still be used, albeit to a less effective extent.

Sellers can also use these graphs as a typical Singaporean, as stated above, can also be a seller. The graphs can be used by them to make better decisions on what price they should sell their flat at.

## 1.1 Factors to care about

### 1.1.1 Remaining Lease

A flat’s lease is 99 years and that once it has finished its lease, it will return to the hands of the government, making it invaluable (Pinky, 2020) the flats will then be recycled and be rebuilt into newer HDB flats for future Singaporeans.

The remaining lease of a flat will affect how much a flat’s resale price is because when a flat’s lease ends, the flat will be considered invaluable and will be returned to the government. Also, the remaining lease affects how much of the buyers’ Central Provident Fund (CPF) can be used to purchase the flat (Pinky, 2020).There are 3 scenarios on how the remaining lease affects this and they are stated below.

ai. If the flat can cover you until you are at least 95, and the lease doesn’t expire before you turn 95:

You’re allowed to use your CPF savings to finance your flat up to the flat’s Valuation Limit which is the current property value or the purchase price of the property, whichever is lower (Pinky, 2020).

aii. If the flat doesn’t cover you until at least 95:

You’ll only be allowed to use your CPF funds up to the Valuation Limit pro-rated according to the length of time the lease can cover you (Pinky, 2020).

aiii. If the flat has less than 20 years of lease remaining:

You’re not allowed to use any CPF savings to finance your flat (Pinky, 2020).

In all instances above, “you” refers to the youngest buyer. For instance, if you’re 30 and your co-homeowning partner is 28, your partner’s age will be used in the calculation. (Pinky, 2020)

### 1.1.2 Location

Whether it is in busier area of the city, or a quieter part. As well as if it is in a more mature area, meaning that the area has been a residential area for roughly 20 years or above, as flats in those areas already have access to a multitude of amenities and facilities built and improved there over the years. Flats in these areas are usually more expensive than in a relatively less mature area.

### 1.1.3 Convenience

This is closely tied with location. Since the number of facilities and amenities available nearby may make people want to live in a flat in that area more, therefore making the price of a flat increase with its convenience.

In terms of its ties with location, since, as stated above, an area that is more mature has more facilities and amenities, the price of a flat that is in a more mature area may mean that it is more expensive compared to newer flats.

### 1.1.4 Layout/Model/Type

A flat’s type, meaning 3-room, 4-room, etc., changes how many square meters a flat is and impacts how much space and how many rooms are available in the flat for you.

Flat layouts continuously change over the years due to the flat models and unlike flat types, where different types mean a different amount of space, flat layouts may make it seem that the amount of space a flat has is lesser compared to others even though they are actually the same.

### 1.1.5 Age

The age of a flat affects the pricing of a flat as a flat that is very old, with an almost finished lease, may not be priced as high as a flat with a rather long remaining lease.

However, as stated previously, more mature flats may be priced higher due to its convenience.

Furthermore, as of 2021, for the past 21 or so years, the amount of space a flat has (counted by square meters) has been consistent. Hence, it is possible that a flat that is older than 21 years may be bigger (Pinky, 2020) or smaller than the current sizes of flats. Therefore, depending on the age of the flat, it’s price may vary.

### 1.1.6 Assumptions and Limitations

Some of the factors, although listed, may not mean that it can be found out accurately through the data given.

Convenience is one of the examples because, although it is listed, we cannot find out how many amenities/facilities are available in each town. The only thing we can do is assume that the older an area is, which is obtained by the taking “the current date - the lease commence date”, the more mature an area is, and the more mature an area is, the more facilities/amenities there are available there, making it more convenient.

The number of resales is dependent on the number of flats actually built there. Therefore, areas such as Lim Chu Kang has a fewer number of resales because of the lesser number of people living there, not because of the quality of the area. However, it can be assumed that an area with a low population, which could be found out with a quick search by the user of the graph, but a typically high er number of resales may mean that the area is one that is unideal to buy the flat in.

## 1.2 Primary Exploratory Questions

1. Does the remaining lease affect the price of the flat?

2. What is the price and its difference compared to others for each type/model of flat?

3. For the same area/block, how much does a different floor affect the price?

4. What is the average price for a flat in each area and how does it compare to the entire city’s average price?

5. What is the trend of the prices and frequency of resale flats over the years?

6. What is the average age of the resale flats in each town and what are their prices?

## 1.3 Buyer’s Perspective

1. Buyers might opt for a flat with a shorter/longer lease, depending on how much the remaining lease affects the selling price of a flat.

2. Just like the remaining lease, the flat type/model would also affect the price of the flat. Buyers would want to know how each flat type/model affects a flat’s overall price to ensure that they are not buying an unreasonably priced flat.

3. The floor level may affect a flat’s price as, depending on which floor you are on, the flat may be hotter/cooler at certain times of day. Assuming here that floor 6 is the optimal floor for a flat, if a flat is at floor 6 but is priced at a price way higher than a flat at floor 4, the buyer may choose to opt for the flat at floor 4 or find a cheaper flat at floor 6 at a different block or area.

4. This is so that the buyer can find out which areas have flats sold at relatively higher or lower prices, so that they can choose which area they may prefer to purchase a flat from, assuming that they do not have a target location already.

5. A buyer may want to know this so that they can see if resale flats are getting more expensive or cheaper. As well as how often the sales are happening, and how often resale flat sale numbers will peak. The trends may also be able to show when the prices for resale flats are the cheapest or most expensive and when is it that there are less sales happening so that they can get the best price and/or have a higher chance of obtaining a flat at a reasonable price, without needing to compete with others too much.

6. A buyer will want to know this as a flat which is in a more mature place and has a long remaining lease, which can be calculated by the flats age as well, will be valuable since they can use their CPF to pay for a portion of the flats price and have a flat at an area with a multitude of facilities and amenities are made available to them. These flats will therefore be priced more competitively, and buyers may want to know how it compares to those of other towns to ensure that they are buying a flat worth their money.

## 1.4 Seller’s Perspective

1. Sellers may adjust the price that they are selling the flat for depending on its remaining to ensure that they are not undercutting themselves or pricing it too unreasonably such that the registration for sake does not get rejected of the price of the flat is so high that nobody wants to buy it.

2. Just like the remaining lease, a flat’s model/type will affect its price. Therefore, buyers would want to know this to ensure that, as stated previously, they are not pricing the flat unreasonably for them and the buyer.

3. Buyers may find this important in order to price their flat competitively so that their flat is more likely to be bought by a buyer.

4. This is so that the seller can know how expensive a flat they are selling in that area is. If the price they set is too low or high compared to the average, the seller can scale their selling prices to something a bit more reasonable or choose not to sell their flat completely if they find that the amount of money they can get from the selling of their flat to be too low for them.

5. A seller may want to know this so that they know what the prime time is to sell their flat, to get the best price for their flat, increase the chances of their flat being sold, or both. If the person is thinking about selling their flat, they can check if selling their flat is worth it or not, meaning if flat sales are an asset that raises in price over time, by seeing if the average resale flat prices raise overtime.

6. A seller may price their flat at a higher price if it is a more mature area and if the remaining lease is rather long for the reasons stated previously above. If the flat is only at a more mature area or only has a long remaining lease, sellers may tend to sell their flats at a cheaper price. By comparing the ages and selling prices of other areas, the seller can set the selling price appropriately. This is so that they do not sell their flat for a lower price and make loses.

# 2. Data Preparation

## 2.1 State of the data

From what I see so far, a good majority of the data are not in the right formats. For example, most of the tables have the months column as a string type instead of a date type, and some of the blocks are formatted as integer when they are supposed to be string type. Also, some of the data is not complete as 3 of the given tables do not have a remaining lease table. Those who do have these tables are in different formats. One in string format, and one in a numerical format. Therefore, I am expecting to do quite a substantial amount of data cleaning.

After making some graphs, I found that some of the names were repeated but in different forms, for example, “2-Room” and “2-ROOM” were considered different flat models when they were in fact the same, just that one is fully uppercase, and the other was not.

After making more graphs, I found that the storey range column had repeating values for some blocks. For example, the block 618 had storey ranges 1 to 3 and 1 to 5 and so on.

## 2.2 How to Prepare Data

For now, I found that making all tables into a union works the best. Thereafter, I changed the format of the values in the unioned tables to their correct formats. For example, the block column is changed to string format, lease commence dates and the month columns are changed to a date format, the resale price column is changed to a decimal format.

The remaining lease column will be kept as a string as some columns do not have a remaining lease column while others have it in either an integer format, telling us the number of years left on the lease, or a string format, telling us the time left on the lease in the form of “XX years XX months”.

To combat this problem, I created a new calculated to field to calculate the remaining lease. The formula I used is

“99 - datediff('year',[Lease Commence Date],TODAY())”

and to double check that I did it right, I used the lease calculator from this link, <https://www.edgeprop.sg/hdb-tenure>, inserted in various postal codes, and compared the results on the website to the results calculated out by my calculation.

Since I also wanted to find the age of the area that the flat was built, I made another calculated field to find it. The formula used is

“datediff('year',[Lease Commence Date],TODAY())”

To combat the problem of repeated flat type and models, I decided to group all the same names. For example, both flat type and model, together and use the grouped version of the data to make the graphs instead of the raw data.

To kind of solve the problem for the repeated storey ranges, I decided to put the storey ranges in groups as well. Ranging from

1 to 6, 6 to 10, 10 to 15, 16 to 21, 21 to 25, 25 to 30, 31 to 36, 36 to 40, 40 to 45,

46 to 51

## 2.3 Further Research Performed

I had to find out a few things such as

1. What a resale flat is

3. What was the time span of a typical flat’s lease

4. What were the different types/models of flats and how they differ from each other

5. What happens to a flat when the lease ends

6. What a mature estate is and why do some people want to buy flats there

7. Why a lease can affect the flats price.

8. What kind of factors a person may consider when buying a flat

9. How a person may budget and consider “worth it” when buying a resale flat

To find these out, I googled and read a few websites on the information. I also went to ask my family members on what they look out for when buying a flat. I then went to read the metadata text file to find out more about the information given to us.

It was only by reading the metadata that I found out that some information was in the wrong formats and what they were supposed to be, as well as how some of the information, such as the remaining lease, was processed and why some information was in the wrong format, like how the remaining lease for 2017 onwards was in a string format but the remaining lease for a different table was in an integer format.

# 3. Exploratory Data Analysis and Visualisation

## 3.1 Visualisation 1

Visualisation 1 (figure 3.1.1) answers the question

Does the remaining lease affect the price of the flat?

It shows the comparison between the average remaining lease and price over the years. It can be filtered by year, flat type, flat model, and town.

The easiest way to interpretate the data, is to compare the trend lines (dotted lines) where the blue one is the trend of the remaining lease in number years, and the red one is the trend for the average flat sales price over the years.

By looking at the trends of the overall comparison, (Figure 3.1.1) we can see that as the remaining lease increases, the prices also increase. The increase of the flat prices is much steeper, and therefore higher than the remaining flat prices. Meaning that the prices increase can be interpreted in such a way that for every 1 year of remaining lease, the price increases by 3-4 times.

However, from 2010 - 2021 (figure 3.1.2), while both the trend of the remaining lease and flat prices are increasing, remaining lease has a steeper incline than resale flat prices. This means that the ratio of remaining lease increase to price increase is one is to a fraction, like 1/4 or 1/5.

If we decrease this time period to 2015 - 2021 (figure 3.1.3) We can see that the remaining lease and prices trends are parallel to each other, meaning that the remaining lease to price increase is one is to one.

For all of the meanings above, the ratios of increase are not the actual multipliers or number. Rather, it is an example used to illustrate the incline of trends.

Hence, it may be safe to say that although the lease does affect the flat price, it only affects it a little bit, since the remaining lease to price increase is roughly 1:1 over a 5-year period, 1:1/4 or 1:1/5 over a 10-year period, and 1:3 or 1:4 over a 20 year period. Therefore, it can be concluded that other factors seem to be affecting the flat price more than the flat’s remaining lease.

For this visualisation, the most important feature here, in my opinion, are the trend lines, as they give you the ability to compare what happens to something overtime. Since here, the prices tend to fluctuate, as well as the remaining lease overtime, using a trend line may be easiest to see if the values are increasing, decrease, or remaining mostly constant.

### Figure 3.1.1

Chart, histogram

Description automatically generated

### Figure 3.1.2

Chart, bar chart, histogram

Description automatically generated

### Figure 3.1.3

Chart

Description automatically generated

## 3.2 Visualisation 2a

Visualisation 2a (figure 3.2.1) answers the question

What is the price and its difference compared to others for each type/model of flat?

It shows the average resale price of the flats categorised by type then model. It can be filtered by the type of flat model and, flat type, and town. The flat type and town filter is not on this visualisation itself because I did not make the filter available for use, but on the dashboard, because it is used to compare sales prices to those of visualisation 2b (figure 3.3.1), which is also when further insights can be found, which is covered below later on.

However, as of now, it is interesting to note that for some models, a smaller flat type may go for a higher price than a bigger flat type, such as the premium apartment loft where the price of a 4-Room one is higher than that of a 5-Room one (Figure 3.2.2). One usually expects it to be the opposite since a 4-Room flat has a smaller area (per sqm) than a 5-Room flat. Hence giving the 5-Room flat more space, and therefore, a higher price.

I used a bar chart for this visualisation as it allows the users to judge the prices in one glance which makes it easier for them to comprehend which ones are comparatively more expensive or cheaper faster. This graph should be used together with graph 2b for more insights into the rough pricings of a graph.

### Figure 3.2.1

Timeline

Description automatically generated

### Figure 3.2.2

Graphical user interface, text, application, email

Description automatically generated

## 3.3 Visualisation 2b

Visualisation 2b (Figure 3.3.1) is a supplementary graph meant to answer the question

What is the price and its difference compared to others for each type/model of flat?

It is the same as graph 2a. However, 2b further breaks down the results into the town and block as well. It can be filtered by block, flat type, flat model, storey range, town, and year. However, only the block filter is available in the visualisation area itself. The rest of the filters are implemented via dashboard. Which will be covered below.

For now, it is interesting to note that flats with the same town, type and model can have their prices vary a lot from one another. For example, the blocks 618 and 619 have flats which are both 5-room and model A (Figure 3.3.2). However, assuming that 618 and 619 are directly beside each other which is most likely, the price for the flat at 618 is more than $100,000 more than the flat at 619.

This scenario is interesting since because the flats are beside each other and are virtually the same, you would assume the prices are similar to each other, but this is not the case. There is a chance other factors are affecting this price as well.

However, looking at the overall results (Figure 3.3.1), the more “premium” models such as terrace, premium apartment loft, etc., generally have a higher price than the “less premium” models like simple or improved.

Similarly, to the above graph 2a, there, bar graphs are used to show the prices and to compare more easily. However, since this graph depends on action filters, etc., using the graph as a whole, without filtering for information specifically, may not help the user that much.

This graph should be used more as a reference for prices of flats when they have a specific type/model/town that they already have in mind. However, if they do already have a block of choice and do not really care for the previously mentioned specifics, they can find out the rough price of the flat in that block and town by extension, since town is included in the filters.

### Figure 3.3.1

Chart, bar chart

Description automatically generated

### Figure 3.3.2

Chart, bar chart

Description automatically generated

## 3.4 Visualisation 2c

Visualisation 2c (Figure 3.4.1) is another graph that answers the question

What is the price and its difference compared to others for each type/model of flat?

It is the essentially the same as graph 2a (Figure 3.2.1) except that it cannot be filtered by town. This is because this graph serves as a reference for the average prices of the flat type/model for the whole nation. This is mainly for the buyer as there is a chance that if they graph shows the prices of blocks for the entire neighbour hood to be higher than the national average, they may consider moving to another area.

### Figure 3.4.1

Timeline

Description automatically generated

## 3.5 Visualisation 3

Visualisation 3 (Figure 3.5.1) answers the question

For the same area/block, how much does a different floor affect the price?

It shows the Average prices of the resale flat categorised by town, block, then floor range. It can be filtered by block, storey range, flat type, and flat model. However, on the visualisation itself, it can only be filtered by block and storey range.

The visualisation is meant to be used by sellers to decide how much their flat is worth, according to the past sales trends of the block, by buyers can use it to determine which floor/block/area they would want a house in.

This is because if we look at blocks 618 and 619 in Bedok (Figure 3.5.2), assuming that the blocks are right beside each other, the flats on level 6 to 10 in 619 have a resale price of $120,000 more than the ones in 618. You would expect that since the blocks are beside each other the flats would have the same price but that is not the case. It may be a case of other factors affecting the price too.

However, skimming through the chart overall, it seems that the prices of the flats increase costs more than the others. Hence meaning that there is a possibility these few floors are the more popular ones for residents. Therefore, they may be priced higher.

Similarly, to graph 2b, this graph should be used with a model/type/town for the best results. However, if they do not care for such but only care for specific floor ranges, the graph can be used to allow them to find the rough price of a flat in their block/floor range of choice by filtering it.

### Figure 3.5.1

Chart, bar chart

Description automatically generated

### Figure 3.5.2

Chart, bar chart

Description automatically generated

## 3.6 Visualisation 4

Visualisation 4 (Figure 3.6.1) answers the question

What is the average price for a flat in each area and how does it compare to the entire city’s average price?

It shows the average resale price per town. It can be filtered by year, flat type, flat model, and block. However, on this visualisation itself, it can only be filtered by year. The rest of the visualisations are only accessible via dashboard.

I used a bar chart for the graph, with a green to blue colour gradient to colour the different prices. This is to allow users to be able to be able to see the difference in price with one glance.

The graph can be used to see trends for price increase/decrease for different year intervals by using the year slider filter so that buyers, since this graph is mostly made for them, can see which towns have a higher/lower average sale price compared to the national average.

### Figure 3.6.1

Chart

Description automatically generated

## 3.7 Visualisation 5a

Visualisation 5a (Figure 3.7.1) answers the question

What is the trend of the prices and frequency of resale flats over the years?

It shows the raw number of the sales and the average resale prices. It can be filtered by town, year, flat type, flat model, storey range, and block. However, Storey range and block are only available in the dashboard.

By using the town, year, flat type, and flat model filters, users are able to find out if the prices and number of resales over the years are increasing or decreasing.

The easiest way to read the chart is by looking at the trend line (grey dotted lines) as the average sales price and number of sales will fluctuate over time, the trend lines can give you a better gauge if the values are increasing or decreasing in price.

Looking at the chart, over the past 20 year, the prices average of the flats are increasing but the sales numbers are decreasing. This may mean that not only are the prices of flats getting more expensive, but since lesser flats are being sold over the years while prices are increasing, the price of a flat now, is higher than that of one in the past by a significant margin.

Looking at the years 2015 - 2021 (Figure 3.7.2), the trend for the number of resales is slightly higher than the average resale prices. This means that in recent years, flats are getting slightly more expensive and there are more people looking to sell/buy flats. Also, the price of the flats over the past 5 or so years is mostly constant.

Lastly, if looking at the sales for 4-Room flats over the past 20 years (Figure 3.7.3), the number of resales is mostly constant, but the prices of the flats are increasing. This supports the figure in the first part (Figure 3.7.1) to a certain extent as it does prove that the prices of flats are continuously increasing significantly over the years.

For this chart, a line chart was used as it will be able to illustrate any sudden spikes or dips the most effectively. This chart is used together with chart 5b, which illustrates the percentage difference as even if the numbers are showing an increase, the percentage differences of the data may illustrate a decrease instead.

The raw number data is there for users to be able to see if there is a chance in terms of only the numbers, without any comparisons to something else as a percentage chart, that may show an increase/decrease in percentage, would cause users to believe that the number has changed dramatically, when in fact, it was only by a small margin.

### Figure 3.7.1

Chart, line chart

Description automatically generated

### Figure 3.7.2

Graphical user interface, chart, application

Description automatically generated

### Figure 3.7.3

Chart, line chart

Description automatically generated

## 3.8 Visualisation 5b

Visualisation 5b (Figure 3.8.1) is a secondary graph to answer the question

What is the trend of the prices and frequency of resale flats over the years?

This chart is similar to the chart in 5a, except that it shows the data in a percentage change form instead. When using the same parameters:

Overall, even though the picture in 5a (Figure 3.7.1) shows an increase in the raw numbers, the percentage change (Figure 3.8.1) shows us that actually, the percentage change is a decrease. So, while the price of the flats does increase, the degree on change is a decrease instead of an increase. For the number of sales, the raw numbers and percentage change are both decreases.

From 2015 to 2021, in 5a (Figure 3.7.2) shows slight increases for both values. However, the percentage changes (Figure 3.8.2) show that there is a sharp increase for the prices and a sharp decrease for the number of sales. This change actually supports the first diagram of 5a (Figure 3.7.1) as it mimics the rise in sales prices but decrease in number of sales, albeit the graph here showing a sharper increase and decrease due to the values of the axis.

For the 4-Room flats overall, in 5a (3.7.3) shows that the prices are increasing but the number of buyers over the years are constant. However, the percentage change chart (Figure 3.8.3) shows that the degree of changes for both are decreases instead.

Using percentage decreases alongside raw numbers are important as raw numbers show how much something actually changes but the percentage changes show the change using the previous year as a benchmark. Therefore, it provides a fair comparison for two areas with different starting numbers, something which the raw numbers cannot do.

### Figure 3.8.1

Chart, line chart

Description automatically generated

### Figure 3.8.2

Chart, line chart

Description automatically generated

### Figure 3.8.3

Chart, line chart

Description automatically generated

## 3.9 Visualisation 6

Visualisation 6 (Figure 3.9.1) answers the question

What is the average age of the resale flats in each town and what are their prices?

The chart is a table with the town, average age, and average price. I chose a table as it shows everything at one glance. Furthermore, the table allows the values to be sorted by town, age, or average price, in both ascending and descending. Since the question does not call for a comparison, a table can also be used.

For a comparison, I would rather use a bar or tree graph so that the difference can be more easily seen. However, since it is not a comparison, the table is better as the 3 separate filters allows the information to be viewed a total of 6 separate ways, according to what the need to find like

a certain town, this is where the first filter for town is useful

the highest/lowest age, which is where the age filter is useful

or the highest/lowest price, where the price filter would be handy.

### Figure 3.9.1

Table

Description automatically generated

## 3.10 Dashboards

### Trends Dashboard (Figure 3.10.1)

This dashboard is used by users to find out the trends for the average prices, the number of sales and which town has the highest number of resales for a range of years. It can be filtered by the block number as well.

This dashboard is mainly for users to figure out if it is worth it to sell their flat or buy a flat at a certain time and how well a certain area is doing.

Users may select their preferred range of years, then search for a town of their choice followed by the block. Users do not have to use all the filters. They can use a combination of them or none if they so wish to. The explanation of filters is given below at 3.10.4.

Chart, line chart

Description automatically generated

### Price Dashboard (Figure 3.10.2)

This dashboard is for users to compare the prices of the area, flat type, flat model, and storey range so that they can figure out the best prices to buy or sell a flat at depending on the various factors.

Buyers/Sellers may select their preferred range of year. Then they can search for a town of their choice followed by block or storey range and then flat type/model and compare prices for the price they are being offered, for buyers, or the price they are giving, for sellers, to find out if the price offered or giving is reasonable or not.

Users do not have to fill in or select every available filter here. They can use a combination of them or none at all if so wished. However, using none of the filters is not that advisable. The explanation of filters is given below at 3.10.4.

Chart

Description automatically generated

### Flats Comparison Dashboard (Figure 3.10.3)

This dashboard is for users to compare the flat price via flat type and flat model for blocks or towns. It can be used with the Price Dashboard (Figure 3.10.2) or as a standalone. However, if used as a standalone, users will be unable to access the filter by town function.

With 3.10.2, after using their filters of choice, the user proceeds to this dashboard to have the flat type/model of their choice be compared to the national average prices, and the prices for their chosen town(s).

The flats can be further filtered by the flat type and flat model to have a clearer comparison between the prices of the flats. The explanation of filters is given below at 3.10.4.

Chart

Description automatically generated

### 3.10.4 Features

#### **3.10.4.1 Year and Block filter**

The year and block filter affects all dashboards at once

Chart, line chart

Description automatically generated

Chart

Description automatically generated

Graphical user interface, chart, application

Description automatically generated

This is so that all comparisons made on all dashboards are for all indicated blocks/timeframes to ensure a mostly fair comparison as well as for easy referencing between dashboards and visuals.

#### **3.10.4.2 Town filter on Trends Dashboard (Figure 3.10.1)**

The bar chart in Figure 3.10.1 (Figure 3.6.1) can act as a filter for the dashboard. The filter acts on both Figure 3.7.1 and Figure 3.8.1, it does not affect Figure 3.10.2 or Figure 3.10.3

Graphical user interface, chart

Description automatically generated

Multiple values can also be selected by holding ctrl and clicking the values of choice. Graphical user interface, chart

Description automatically generated

#### **3.10.4.3 Town filter on Price Dashboard (Figure 3.10.2)**

The table on the dashboard acts as a filter. It affects both bar charts in the table (Figure 3.5.1 and Figure 3.3.1)

Chart

Description automatically generated

As well as the two bar charts on the right (Figure 3.2.1 and Figure 3.3.1) of 3.10.3, for a relatively fairer comparison and easier referencing.

Graphical user interface, chart, application

Description automatically generated

Similar to the feature mentioned in 3.10.4.2, multiple towns can be selected from the table by holding ctrl and pressing the values of choice.Chart

Description automatically generated

#### **3.10.4.4 Flat Type/Model Filter on Flats Comparison Dashboard (Figure3.10.3)**

The Bar chart on the left of Figure 3.10.3 can be used as a filter to filter the dashboard by flat type/flat model. It affects the Two bar charts on the right (Figure 3.2.1 and Figure 3.3.1)

Graphical user interface, chart

Description automatically generated

As well as the bottom right chart on Figure 3.10.2 (Figure 3.3.1)Chart

Description automatically generated

Similar to the filters mentioned in 3.10.4.2 and 3.10.4.3, multiple values can be selected by holding ctrl and selecting the values of choice.Graphical user interface, table

Description automatically generated

This filter function is meant for the user to be able to find their flat type/model of choice much more easily. The filter can be used without any other filters being used with it if they user wishes to do so.

#### **3.10.4.5 Storey Range Filter**

The storey range filter affects the two bar charts on the right (Figure 3.2.1 and Figure 3.3.1) of 3.10.3

Chart

Description automatically generated

As well as the bar chart on the bottom right of 3.10.3 (Figure 3.3.1)Graphical user interface, chart, application

Description automatically generated

This is added in for the user to have an easier time comparing the prices.

# 4. References

Pinky. (2020, October 14). *The ultimate BTO vs resale guide: All the factors you need to consider*. Retrieved December 12, 2021, from Carousell: https://blog.carousell.com/property/bto-resale-hdb-singapore/