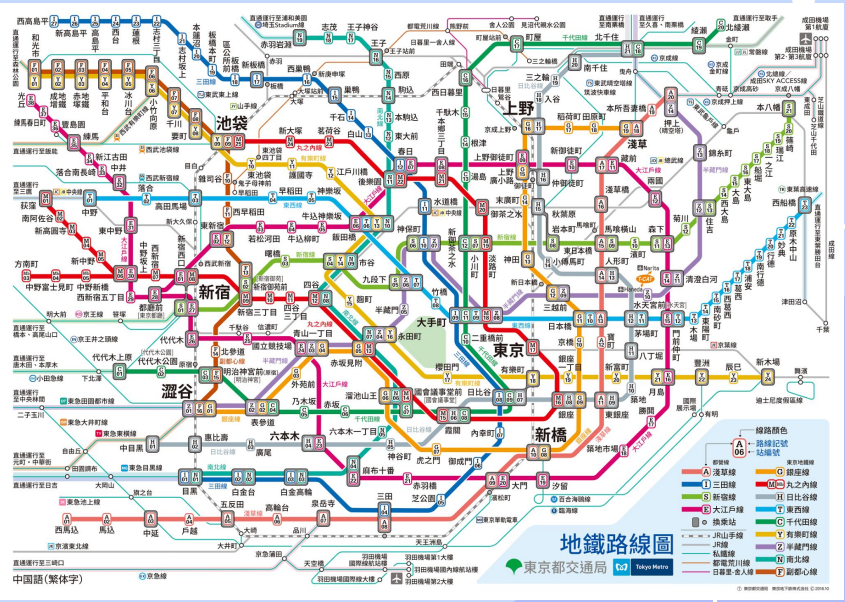
Metro Calculator

黃茂勛 吳冠勳 蘇建安 陳彥融

Introduction

Use a simple tool to calculate the most time-saving way or money-saving way of all routes in metro graph



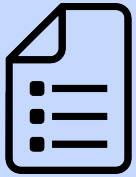
Flow

Input a metro graph

Input a start point

Input a destination

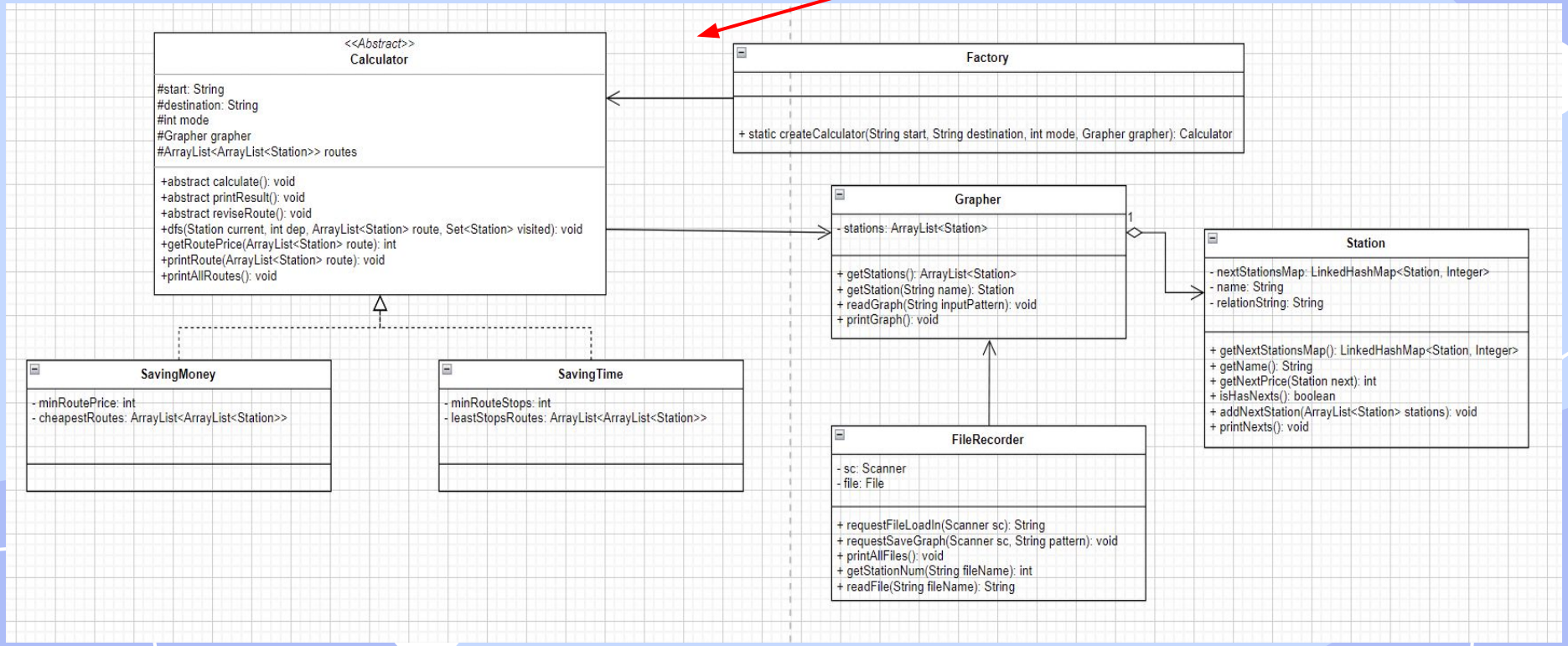
Calculate the result



Graph saving

Structure

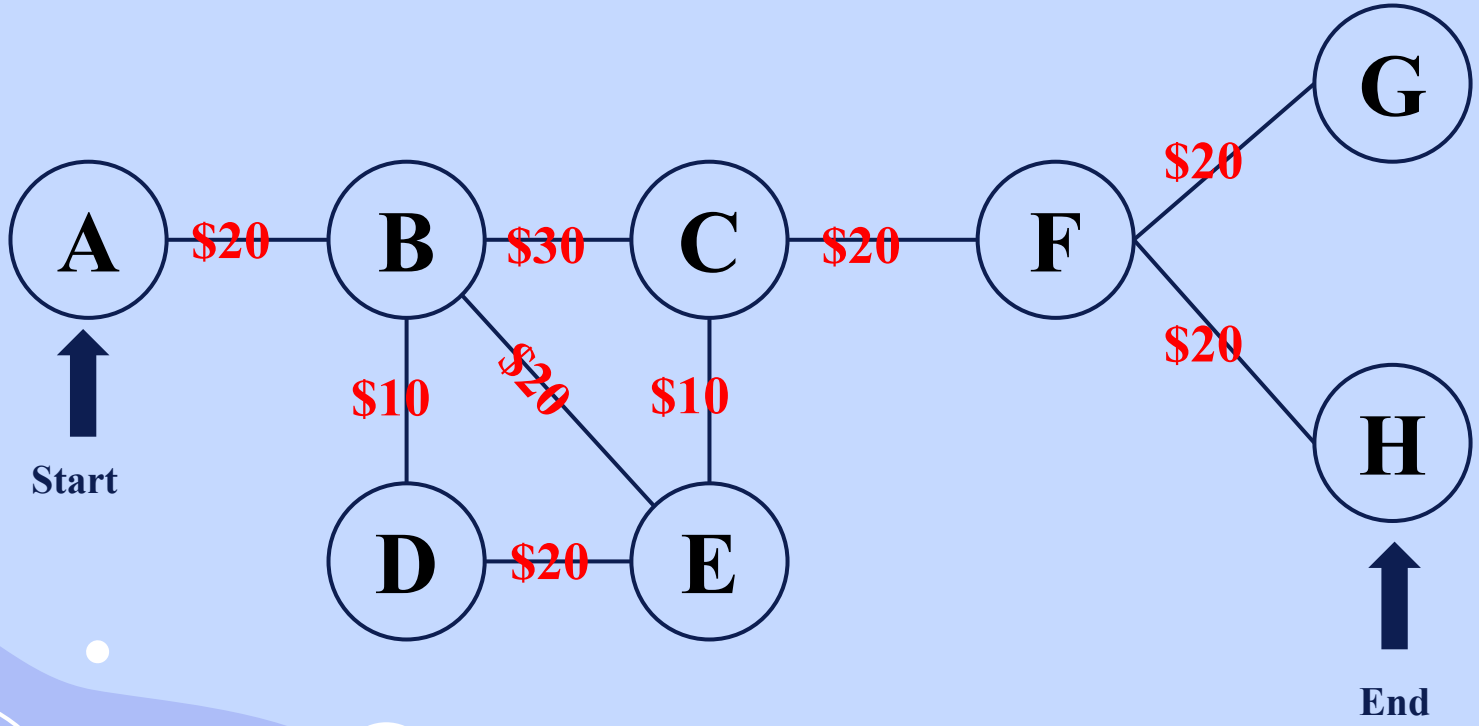
OOP SOLID, SImple Factory Pattern



Needed Skill

- Abstract Class
- Inheritance
- Polymorphism
- Simple Factory Pattern
- DFS (Depth First Search)
- HashMap, Set

Simple Demo



DFS implement calculating

```java
public void dfs(Station current, int dep, ArrayList<Station> route, Set<Station> visited) {
    if(current.getName().equals(destination) || !current.isHasNexts())
    {
        route.add(dep, current); //add last node
        visited.add(current);
        if(current.getName().equals(destination))
        {
            ArrayList<Station> copyRoute = new ArrayList<Station>(route); //copy a new route, not the copy reference
            routes.add(copyRoute);
        }
        return;
    }

    //add
    route.add(dep, current);

    //is visited
    if(!visited.contains(current))
    {
        visited.add(current);
    }

    for(Station next : current.getNextStationsMap().keySet())
    {
        if(!visited.contains(next))
        {
            //search
            dfs(next, dep+1, route, visited);

            //reset
            route.remove(dep+1); //remove by index
            visited.remove(next); //remove by reference
        }
    }
}
```

Simple Demo (Previous Graph)

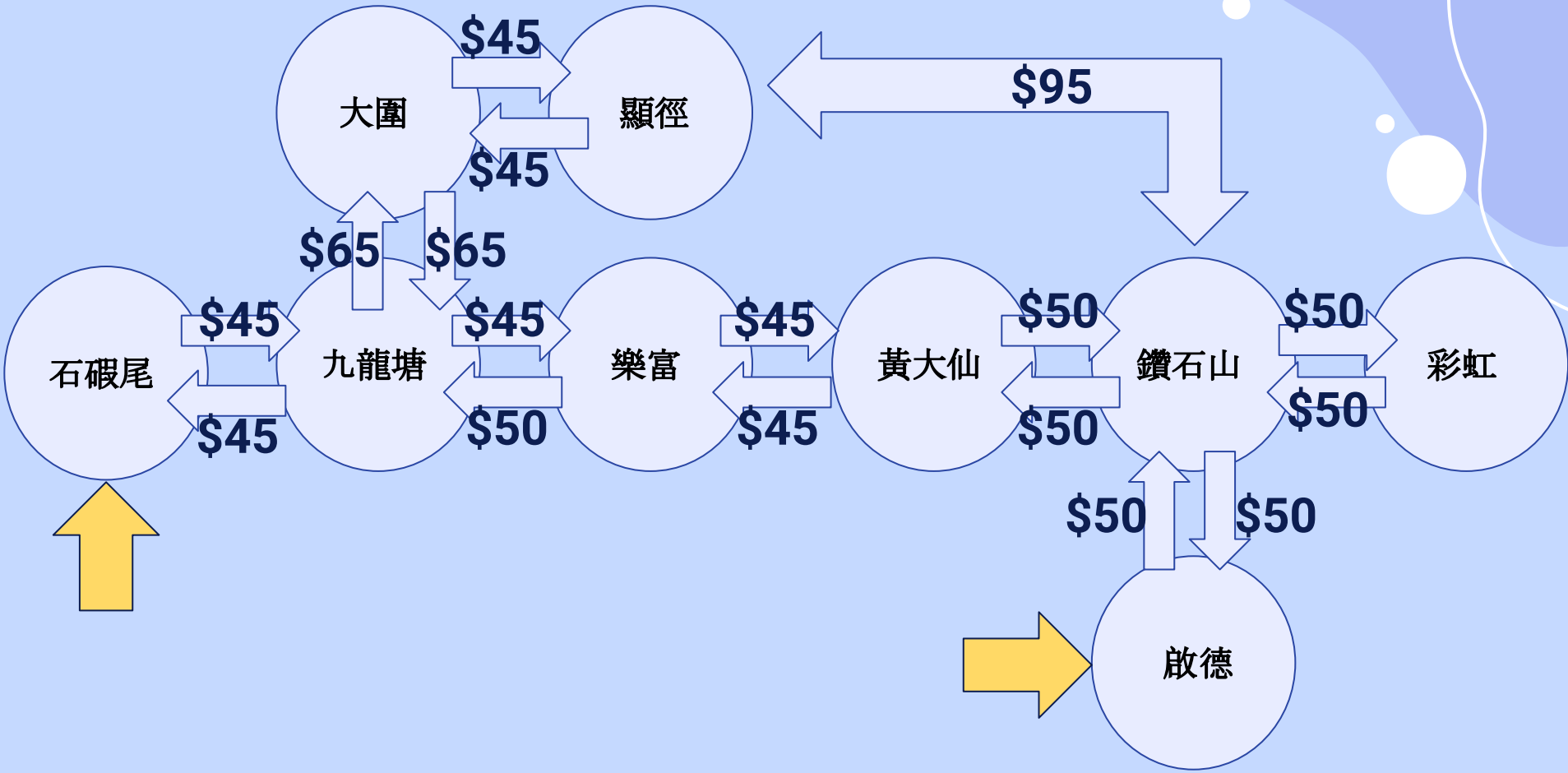
Input Format

```
A: B(20)
B: A(20), D(10), E(20), C(30)
C: B(30), E(10), F(20)
D: B(10), E(20)
E: D(20), B(20), C(10)
F: C(20), G(20), H(20)
G: F(20)
H: F(20)
```

```
----------------------------------------
   Welcome to Metro Calculator ! ! !
----------------------------------------

Do you want to load present file of metro graph? (y/N): y
The following are the present file.
ExampleGraph.txt 台北捷運中央.txt
Please choose one file and enter the full name: ExampleGraph.txt

----------------------------------------

The below is your metro graph:
A --> B(20)
B --> A(20), D(10), E(20), C(30)
C --> B(30), E(10), F(20)
D --> B(10), E(20)
E --> D(20), B(20), C(10)
F --> C(20), G(20), H(20)
G --> F(20)
H --> F(20)

Which station do you want to start: A
Which station is your destination: H
Which mode do you want to choose? (1)most saving money (2)most saving time(least stations): 1

----------------------------------------

All routes:
     • A --($20)--> B --($10)--> D --($20)--> E --($10)--> C --($20)--> F --($20)--> H | sum price: 100, all stops: 7
     • A --($20)--> B --($20)--> E --($10)--> C --($20)--> F --($20)--> H | sum price: 90, all stops: 6
     • A --($20)--> B --($30)--> C --($20)--> F --($20)--> H | sum price: 90, all stops: 5
Among these routes
The most saving money ways are:
     • A --($20)--> B --($20)--> E --($10)--> C --($20)--> F --($20)--> H | sum price: 90, all stops: 6
       Cost $90, Stops 6

     • A --($20)--> B --($30)--> C --($20)--> F --($20)--> H | sum price: 90, all stops: 5
       Cost $90, Stops 5

----------------------------------------

Do you want to save the graph? (y/N): N
Thanks for using metro calculator !
```

Examples

If you want to turn this concept into input data, you need to …


大圍
顯徑
$45
$45
$95
$65
$65
石硤尾
九龍塘
樂富
黃大仙
鑽石山
彩虹
啟德
$45
$45
$45
$50
$45
$45
$50
$50
$50
$50
$50
$50

Example - input

```
----------------------------------------
   Welcome to Metro Calculator ! ! !
----------------------------------------

Do you want to load present file of metro graph? (y/N): N
How many stations do you want to type in: 9
Please input the metro graph (eg. A: B(20), C(10)) :
大圍: 九龍塘(65), 顯徑(40)
九龍塘: 大圍(65), 樂富(45), 石硤尾(45)
石硤尾: 九龍塘(45)
顯徑: 大圍(40), 鑽石山(95)
鑽石山: 黃大仙(50), 顯徑(95), 啟德(50), 彩虹(50)
黃大仙: 鑽石山(50), 樂富(45)
樂富: 九龍塘(50), 黃大仙(45)
彩虹: 鑽石山(50)
啟德: 鑽石山(50)
```

Example - input

```
Which station do you want to start: 石碇尾
Which station is your destination: 啟德
Which mode do you want to choose? (1)most saving money (2)most saving time(least stations): 1
```

It is required to choose the mode you prefer.

Example - Money Saving

```
----------------------------------------

All routes:
     • 石硤尾 --($45)--> 九龍塘 --($65)--> 大圍 --($40)--> 顯徑 --($95)--> 鑽石山 --($50)--> 啟德 | sum price: 295, all stops: 6
     • 石硤尾 --($45)--> 九龍塘 --($45)--> 樂富 --($45)--> 黃大仙 --($50)--> 鑽石山 --($50)--> 啟德 | sum price: 235, all stops: 6
Among these routes
The most saving money ways are:
     • 石硤尾 --($45)--> 九龍塘 --($45)--> 樂富 --($45)--> 黃大仙 --($50)--> 鑽石山 --($50)--> 啟德 | sum price: 235, all stops: 6
       Cost $235, Stops 6

----------------------------------------
```

Example - Time Saving

```
----------------------------------------

All routes:
     • 石硤尾 --($45)--> 九龍塘 --($65)--> 大圍 --($40)--> 顯徑 --($95)--> 鑽石山 --($50)--> 啟德 | sum price: 295, all stops: 6
     • 石硤尾 --($45)--> 九龍塘 --($45)--> 樂富 --($45)--> 黃大仙 --($50)--> 鑽石山 --($50)--> 啟德 | sum price: 235, all stops: 6
Among these routes
The most saving time ways are:
     • 石硤尾 --($45)--> 九龍塘 --($65)--> 大圍 --($40)--> 顯徑 --($95)--> 鑽石山 --($50)--> 啟德 | sum price: 295, all stops: 6
       Cost $295, Stops 6

     • 石硤尾 --($45)--> 九龍塘 --($45)--> 樂富 --($45)--> 黃大仙 --($50)--> 鑽石山 --($50)--> 啟德 | sum price: 235, all stops: 6
       Cost $235, Stops 6

----------------------------------------
```

Challenge

- **Flexibility v.s Abundant Input**

```
Do you want to load present file of metro graph? (y/N): N
How many stations do you want to type in: 9
Please input the metro graph (eg. A: B(20), C(10)) :
大圍: 九龍塘(65), 顯徑(40)
九龍塘: 大圍(65), 樂富(45), 石硤尾(45)
石硤尾: 九龍塘(45)
顯徑: 大圍(40), 鑽石山(95)
鑽石山: 黃大仙(50), 顯徑(95), 啟德(50), 彩虹(50)
黃大仙: 鑽石山(50), 樂富(45)
樂富: 九龍塘(50), 黃大仙(45)
彩虹: 鑽石山(50)
啟德: 鑽石山(50)
```

The bigger the data is, the more the users need to input.

Solution - File Saving

```
Do you want to save the graph? (y/N): y
Please input the file name: HK.txt
Thanks for using metro calculator !
```

(at the end of using calculator)

```
----------------------------------------
   Welcome to Metro Calculator ! ! !
----------------------------------------

Do you want to load present file of metro graph? (y/N): y
The following are the present file.
HK.txt
Please choose one file and enter the full name: HK.txt

----------------------------------------
```

(at the beginning)

Solution - File Saving

There are some ways to pre-establish the data:

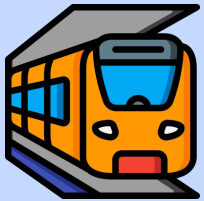
- **manual inputs**
- **net-crawling**

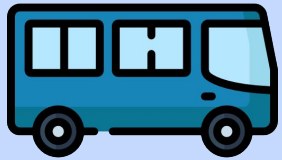
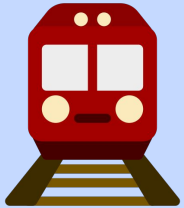
Advantage

- The calculator provides two particular ways, the most time-saving and money-saving, which allows users to choose
- users can get all routes available from their starting points to destinations
- users can get informed of how much they need to spend and how much time it takes for all the routes, which makes it clear to compare or be useful when drawing up plans

Future

- Extending the range of application to other kinds of public transportation system such as bus, train and even airplane
- Combining the MRT and bus system, taking both of which into account and calculating the final results.
- Letting the calculator enable to provide the information of some of public transportation system in other countries, like JR, London Underground, New York City Subway and so forth




Thanks for listening !