REPORT

보고서 작성 서약서

1. 나는 타학생의 보고서를 복사(Copy)하지 않았습니다.
2. 나는 타학생의 보고서를 인터넷에서 다운로드 하여 대체하지 않았습니다.
3. 나는 타인에게 보고서 제출 전에 보고서를 보여주지 않았습니다.
4. 보고서 제출 기한을 준수하였습니다.

나는 보고서 작성시 위법 행위를 하지 않고,
성.균.인으로서 나의 명예를 지킬 것을 약속합니다.

과 목 : 컴퓨터 구조
과 제 명 : Project phase 1
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-Target Problem

In this project you find a shortest tour starting from City-1 and finally reaching City-7, while visiting the cities only once. The coordinates of the cities are
City-1(5 ,5), City -2(2,3), City -3(8,4), City -4(7,2), City -5(1,6), City -6(9,6), City -7(3,2).

You need to find the tour in terms of the sequence of the cities visited and the traveling distance.

- The algorithm adopted

Since start and goal are given, we consider A* algorithm superior to Dijkstra algorithm. So we choose A* algorithm.

[Description]

A* uses a breadth-first search and finds a least-cost path from a given initial node to one goal node. As A* traverses the graph, it follows a path of the lowest expected total cost or distance, keeping a sorted priority queue of alternate path segments along the way.

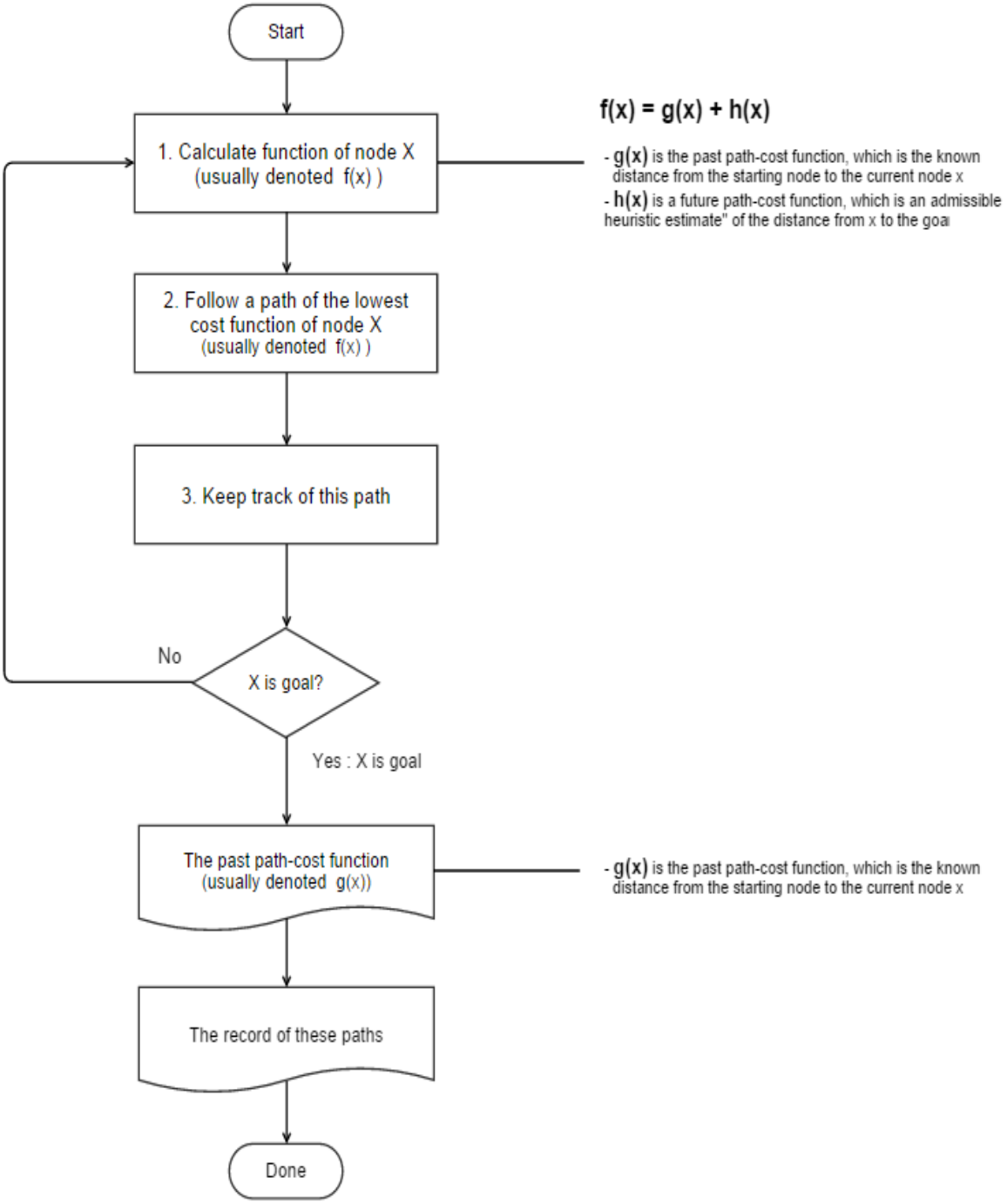
It uses a knowledge-plus-heuristic cost function of node x ( ) to determine the order in which the search visits nodes in the tree.

$$f(x) = g(x) + h(x)$$

- $g(x)$ is the past path-cost function, which is the known distance from the starting node to the current node x
- $h(x)$ is a future path-cost function, which is an admissible "heuristic estimate" of the distance from x to the goal

*refereced by http://en.wikipedia.org/wiki/A*_search_algorithm

- Flow chart



*We used gliffy- tool. Why don't you try this?
https://www.gliffy.com/go/html5/launch?app=1b5094b0-6042-11e2-bcfd-0800200c9a66

- Source code

```
#include <iostream>
#include <math.h>
#include <queue>
#include <math.h>
using namespace std;

struct city{
	int x;
	int y;
};

struct path{
	double city[7];
	double cost;
	double distant;
	int current;
	int size;
	int list[7];
};

priority_queue < path, vector<path>, less<path>> P_pq;

bool operator< (const path& structp1, const path&structp2)
{
	return structp1.cost > structp2.cost;
}

city Travel[7];
void make_distant(path* p){
	for (int i = 0; i < 7; i++){
		if (p->list[i] != -1)
			p->distant += p->city[p->list[i]];

	}
}
double dist(city a, city b){
	return sqrt((a.x - b.x)*(a.x - b.x) + (a.y - b.y)*(a.y - b.y));
}

bool is_visited(path P, int a){
	for (int i = 0; i < 7; i++){
		if (P.list[i] == a)
			return true;
	}
	return false;

}

void PUSH(path now, int n_city){
	path next = now;
	next.city[n_city] = dist(Travel[now.current], Travel[n_city]);
```

```
		next.current = n_city;
		next.cost = next.city[0] + next.city[1] + next.city[2] + next.city[3] + next.city[4] +
next.city[5] + next.city[6];
		next.list[now.size] = n_city;
		next.size = now.size + 1;
		make_distant(&next);
		P_pq.push(next);
}

void move(path P){
		if (!P_pq.empty())
			P_pq.pop();
		for (int i = 0; i < 7; i++){
			if (P.size != 7 ){
				if (is_visited(P, i) == false)
					PUSH(P, i);
			}
		}

}


bool check_goal(path P){
		if (P.list[6] == 6)
			return true;
		else
			return false;
}

void A_star(path P){
		int end;

		for (int i = 0; i < 7; i++)
			cout << P.list[i]+1 << "	";
		cout << "distant : " << P.distant;
		cout << endl;
		if (check_goal(P)){
			cout << "Goal!" << endl;
			cin >> end;
		}

		move(P);

		A_star(P_pq.top());
}

int main(void){

		Travel[0].x = 5, Travel[0].y = 5;
		Travel[1].x = 2, Travel[1].y = 3;
		Travel[2].x = 8, Travel[2].y = 4;
		Travel[3].x = 7, Travel[3].y = 2;
		Travel[4].x = 1, Travel[4].y = 6;
		Travel[5].x = 9, Travel[0].y = 6;
```

```
	Travel[6].x = 3, Travel[0].y = 2;

	path Sholtest;
	Sholtest.city[0] = 0;
	Sholtest.current = 0;
	Sholtest.list[0] = 0;
	Sholtest.size = 1;
	Sholtest.distant = 0;

	for (int i = 1; i < 7; i++){
		Sholtest.city[i] = 100;
		Sholtest.list[i] = -1;
		for (int j = 1; j < 7; j++){
			if (j != i){
				if (Sholtest.city[i] > dist(Travel[j], Travel[i]))
					Sholtest.city[i] = dist(Travel[j], Travel[i]);
			}
		}
	}

	P_pq.push(Sholtest);
	A_star(Sholtest);



	cin >> Travel[0].x;
}
```

- The output

```
1       0       0       0       0       0       0       distant : 0
1       3       0       0       0       0       0       distant : 3.16228
1       3       4       0       0       0       0       distant : 5.39835
1       3       6       0       0       0       0       distant : 5.39835
1       5       0       0       0       0       0       distant : 4.12311
1       4       0       0       0       0       0       distant : 3.60555
1       4       3       0       0       0       0       distant : 5.84162
1       4       3       6       0       0       0       distant : 8.07769
1       6       0       0       0       0       0       distant : 4.12311
1       6       3       0       0       0       0       distant : 6.35917
1       6       3       4       0       0       0       distant : 8.59524
1       7       0       0       0       0       0       distant : 3.60555
1       7       2       0       0       0       0       distant : 5.01976
1       7       2       5       0       0       0       distant : 8.18204
1       2       0       0       0       0       0       distant : 3.60555
1       2       5       0       0       0       0       distant : 6.76783
1       2       7       0       0       0       0       distant : 5.01976
1       5       2       0       0       0       0       distant : 7.28538
1       5       2       7       0       0       0       distant : 8.6996
1       3       6       4       0       0       0       distant : 9.87048
1       3       4       6       0       0       0       distant : 9.87048
1       2       7       5       0       0       0       distant : 9.4919
1       7       5       0       0       0       0       distant : 8.07769
1       3       4       7       0       0       0       distant : 9.39835
1       3       4       7       2       0       0       distant : 10.8126
1       3       4       7       2       5       0       distant : 13.9748
1       4       6       0       0       0       0       distant : 8.07769
1       4       6       3       0       0       0       distant : 10.3138
1       7       4       0       0       0       0       distant : 7.60555
1       7       4       3       0       0       0       distant : 9.84162
1       7       4       3       6       0       0       distant : 12.0777
1       4       7       0       0       0       0       distant : 7.60555
1       2       7       4       0       0       0       distant : 9.01976
1       4       7       2       0       0       0       distant : 9.01976
1       2       7       4       3       0       0       distant : 11.2558
1       4       7       2       5       0       0       distant : 12.182
1       2       7       4       3       6       0       distant : 13.4919
1       5       7       0       0       0       0       distant : 8.59524
1       5       7       2       0       0       0       distant : 10.0095
1       6       4       0       0       0       0       distant : 8.59524
1       6       4       3       0       0       0       distant : 10.8313
1       5       2       7       4       0       0       distant : 12.6996
1       6       3       4       7       0       0       distant : 12.5952
1       5       2       7       4       3       0       distant : 14.9357
1       6       3       4       7       2       0       distant : 14.0095
1       5       2       7       4       3       6       distant : 17.1717
1       6       3       4       7       2       5       distant : 17.1717
1       3       4       2       0       0       0       distant : 10.4974
1       3       4       2       5       0       0       distant : 13.6596
1       3       4       2       7       0       0       distant : 11.9116
1       3       4       7       5       0       0       distant : 13.8705
1       3       7       0       0       0       0       distant : 8.54744
1       3       7       2       0       0       0       distant : 9.96166
1       3       7       2       5       0       0       distant : 13.1239
1       3       4       5       0       0       0       distant : 12.6094
1       3       5       0       0       0       0       distant : 10.4424
1       2       4       0       0       0       0       distant : 8.70457
1       7       2       4       0       0       0       distant : 10.1188
1       2       4       3       0       0       0       distant : 10.9406
1       7       2       4       3       0       0       distant : 12.3549
1       2       4       3       6       0       0       distant : 13.1767
1       4       2       0       0       0       0       distant : 8.70457
1       7       2       4       3       6       0       distant : 14.5909
1       4       2       5       0       0       0       distant : 11.8668
1       4       2       7       0       0       0       distant : 10.1188
1       2       5       7       0       0       0       distant : 11.24
1       7       5       2       0       0       0       distant : 11.24
```

```
1       4       7       5       0       0       0       distant : 12.0777
1       4       3       7       0       0       0       distant : 11.2268
1       7       3       0       0       0       0       distant : 8.99072
1       4       3       7       2       0       0       distant : 12.641
1       7       3       4       0       0       0       distant : 11.2268
1       7       3       6       0       0       0       distant : 11.2268
1       4       3       7       2       5       0       distant : 15.8033
1       2       7       3       0       0       0       distant : 10.4049
1       2       7       3       4       0       0       distant : 12.641
1       2       7       3       6       0       0       distant : 12.641
1       4       5       0       0       0       0       distant : 10.8167
1       4       3       5       0       0       0       distant : 13.1217
1       5       2       4       0       0       0       distant : 12.3844
1       6       3       4       2       0       0       distant : 13.6943
1       5       2       4       3       0       0       distant : 14.6205
1       6       3       4       2       5       0       distant : 16.8565
1       6       3       4       2       7       0       distant : 15.1085
1       5       2       4       3       6       0       distant : 16.8565
1       3       2       0       0       0       0       distant : 9.24504
1       3       2       5       0       0       0       distant : 12.4073
1       3       2       7       0       0       0       distant : 10.6593
1       3       6       4       7       0       0       distant : 13.8705
1       3       6       4       7       2       0       distant : 15.2847
1       3       6       4       7       2       5       distant : 18.447
1       3       6       5       0       0       0       distant : 13.3983
1       5       7       4       0       0       0       distant : 12.5952
1       5       7       4       3       0       0       distant : 14.8313
1       5       7       4       3       6       0       distant : 17.0674
1       6       3       4       7       5       0       distant : 17.0674
1       5       2       7       3       0       0       distant : 14.0848
1       6       3       7       0       0       0       distant : 11.7443
1       5       2       7       3       4       0       distant : 16.3208
1       5       2       7       3       6       0       distant : 16.3208
1       6       3       7       2       0       0       distant : 13.1586
1       6       3       7       2       5       0       distant : 16.3208
1       3       4       2       7       5       0       distant : 16.3837
1       6       3       4       5       0       0       distant : 15.8063
1       5       4       0       0       0       0       distant : 11.3342
1       5       4       3       0       0       0       distant : 13.5703
1       5       4       3       6       0       0       distant : 15.8063
1       6       3       5       0       0       0       distant : 13.6393
1       5       3       0       0       0       0       distant : 11.4032
1       5       3       4       0       0       0       distant : 13.6393
1       5       3       6       0       0       0       distant : 13.6393
1       4       3       2       0       0       0       distant : 11.9244
1       2       3       0       0       0       0       distant : 9.68831
1       4       3       2       5       0       0       distant : 15.0867
1       4       3       2       7       0       0       distant : 13.3386
1       2       3       4       0       0       0       distant : 11.9244
1       2       3       6       0       0       0       distant : 11.9244
1       7       2       3       0       0       0       distant : 11.1025
1       7       2       3       4       0       0       distant : 13.3386
1       7       2       3       6       0       0       distant : 13.3386
1       7       4       6       0       0       0       distant : 12.0777
1       7       4       6       3       0       0       distant : 14.3138
1       2       7       4       6       0       0       distant : 13.4919
1       2       7       4       6       3       0       distant : 15.728
1       3       7       5       0       0       0       distant : 13.0196
1       4       3       6       5       0       0       distant : 16.0777
1       4       2       7       5       0       0       distant : 14.5909
1       5       2       3       0       0       0       distant : 13.3681
1       6       3       2       0       0       0       distant : 12.4419
1       5       2       3       4       0       0       distant : 15.6042
1       5       2       3       6       0       0       distant : 15.6042
1       6       3       2       7       0       0       distant : 13.8561
1       6       3       2       5       0       0       distant : 15.6042
1       3       4       7       5       2       0       distant : 17.0328
1       4       3       7       5       0       0       distant : 15.6989
1       3       7       4       0       0       0       distant : 12.5474
1       5       2       7       4       6       0       distant : 17.1717
```

```
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1	3	7	4	0	0	0	distant : 12.5474
1	5	2	7	4	6	0	distant : 17.1717
1	6	4	7	0	0	0	distant : 12.5952
1	5	2	7	4	6	3	distant : 19.4078
1	6	4	7	2	0	0	distant : 14.0095
1	6	4	7	2	5	0	distant : 17.1717
1	3	6	7	0	0	0	distant : 12.6094
1	3	6	7	2	0	0	distant : 14.0237
1	3	6	7	2	5	0	distant : 17.1859
1	3	4	5	2	0	0	distant : 15.7717
1	3	4	5	2	7	0	distant : 17.1859
1	5	6	0	0	0	0	distant : 12.1231
1	5	6	3	0	0	0	distant : 14.3592
1	5	6	3	4	0	0	distant : 16.5952
1	6	5	0	0	0	0	distant : 12.1231
1	3	5	2	0	0	0	distant : 13.6047
1	3	5	2	7	0	0	distant : 15.0189
1	3	6	4	2	0	0	distant : 14.9695
1	3	6	4	2	5	0	distant : 18.1318
1	3	6	4	2	7	0	distant : 16.3837
1	5	7	2	4	0	0	distant : 15.1085
1	6	3	4	2	7	5	distant : 19.5806
1	5	7	2	4	3	0	distant : 17.3445
1	5	7	2	4	3	6	distant : 19.5806
1	3	2	7	5	0	0	distant : 15.1314
1	4	7	5	2	0	0	distant : 15.24
1	2	5	7	4	0	0	distant : 15.24
1	2	5	7	4	3	0	distant : 17.476
1	2	5	7	4	3	6	distant : 19.7121
1	3	6	4	7	5	0	distant : 18.3426
1	4	7	3	0	0	0	distant : 12.9907
1	4	7	3	6	0	0	distant : 15.2268
1	3	6	2	0	0	0	distant : 13.0141
1	3	6	2	5	0	0	distant : 16.1764
1	3	6	2	7	0	0	distant : 14.4283
1	4	3	6	7	0	0	distant : 15.2888
1	7	2	5	4	0	0	distant : 15.3931
1	7	6	0	0	0	0	distant : 10.8167
1	2	5	4	0	0	0	distant : 13.9789
1	4	3	6	7	2	0	distant : 16.703
1	7	2	5	4	3	0	distant : 17.6292
1	7	6	3	0	0	0	distant : 13.0527
1	2	5	4	3	0	0	distant : 16.215
1	4	3	6	7	2	5	distant : 19.8653
1	7	2	5	4	3	6	distant : 19.8653
1	7	6	3	4	0	0	distant : 15.2888
1	2	5	4	3	6	0	distant : 18.4511
1	2	7	6	0	0	0	distant : 12.2309
1	4	5	2	0	0	0	distant : 13.9789
1	2	7	6	3	0	0	distant : 14.4669
1	4	5	2	7	0	0	distant : 15.3931
1	2	7	6	3	4	0	distant : 16.703
1	5	7	3	0	0	0	distant : 13.9804
1	5	7	3	4	0	0	distant : 16.2165
1	5	7	3	6	0	0	distant : 16.2165
1	6	3	7	5	0	0	distant : 16.2165
1	3	6	4	5	0	0	distant : 17.0816
1	2	5	3	0	0	0	distant : 14.0479
1	7	2	5	3	0	0	distant : 15.4622
1	4	3	5	2	0	0	distant : 16.284
1	2	5	3	4	0	0	distant : 16.284
1	2	5	3	6	0	0	distant : 16.284
1	7	2	5	3	4	0	distant : 17.6982
1	7	2	5	3	6	0	distant : 17.6982
1	4	3	5	2	7	0	distant : 17.6982
1	7	2	4	6	0	0	distant : 14.5909
1	7	2	4	6	3	0	distant : 16.827
1	2	4	6	0	0	0	distant : 13.1767
1	2	4	6	3	0	0	distant : 15.4128
```

```
1       4       3       2       7       5       0       distant : 17.8107
1       3       2       7       4       0       0       distant : 14.6593
1       3       6       5       2       0       0       distant : 16.5606
1       3       6       5       2       7       0       distant : 17.9748
1       6       3       4       7       5       2       distant : 20.2297
1       7       2       6       0       0       0       distant : 12.6355
1       7       2       6       3       0       0       distant : 14.8716
1       7       2       6       3       4       0       distant : 17.1077
1       4       3       6       2       0       0       distant : 15.6935
1       2       6       0       0       0       0       distant : 11.2213
1       4       3       6       2       5       0       distant : 18.8557
1       4       3       6       2       7       0       distant : 17.1077
1       2       6       3       0       0       0       distant : 13.4574
1       2       6       3       4       0       0       distant : 15.6935
1       4       6       3       7       0       0       distant : 15.6989
1       7       3       6       4       0       0       distant : 15.6989
1       7       3       4       6       0       0       distant : 15.6989
1       2       7       3       6       4       0       distant : 17.1131
1       4       6       3       7       2       0       distant : 17.1131
1       2       7       3       4       6       0       distant : 17.1131
1       4       6       3       7       2       5       distant : 20.2754
1       6       3       7       4       0       0       distant : 15.7443
1       2       4       7       0       0       0       distant : 12.7046
1       7       4       2       0       0       0       distant : 12.7046
1       7       4       2       5       0       0       distant : 15.8668
1       3       4       2       5       7       0       distant : 18.1318
1       6       7       0       0       0       0       distant : 11.3342
1       5       2       7       6       0       0       distant : 15.9107
1       6       3       4       5       2       0       distant : 18.9686
1       6       7       2       0       0       0       distant : 12.7484
1       5       2       7       6       3       0       distant : 18.1468
1       6       3       4       5       2       7       distant : 20.3828
Goal!
```