

## Programming Assignment 2

(200 points)

Assigned Date: Wednesday, October 19, 2011

### Due Date:

<b>Phase I Pseudocode presentation</b>	<b>5:30 PM Monday, October 24, 2011</b>
<b>Phase II Implementation</b>	<b>11:59 PM Sunday, November 13, 2011</b>

### Educational Goal

Become familiar with informed search strategies.

### Requirements

#### NHL Realignment

In the National Hockey League, there are 30 independent ice hockey teams. Each of these teams will play 82 official NHL games each year. Many teams will have to travel across the USA and Canada to play games. Minimizing the amount of travel required to play this schedule is important to the teams of the league (In 2011, the Atlanta Thrashers moved to Winnipeg, Manitoba, and renamed themselves the Jets. The Thrashers were formerly in the Southeast Division and the Eastern Conference. Next year they will probably be in the Western conference. Now the NHL must figure out how to realign their divisions).

The NHL is arranged by:

- Two conferences, each consisting of 15 teams.
- Six divisions, each consisting of 5 teams.
- Each conference contains three whole divisions.

**Task: Find the best alignment for two conferences and six divisions to minimize travel among those groups.**

By geographically arranging the teams into these groups, the league hopes to minimize travel.

The schedule of each team is as follows:

- For every other team in one's own division, 6 games will be played.
- For every other team in one's own conference, but not in the division, 4 games will be played.
- For every team not in one's own conference, one game will be played.

- Three other games will be played against randomly selected opponents from the other conference.
- Any game played between any two teams must be played at one of the two teams' arenas.

So suppose we choose the league's conference and division splits. Then it should be possible to estimate the total travel distance:

$\mu(\text{NHLState}) =$

**(total distance between intra-division teams) x 6 +**

**(total distance between intra-conference, inter-division teams) x 4 +**

**(total distance between inter-conference teams) x 1.2**

This will be the objective function of the problem.

Each NHLState will contain data associating each city with a division and a conference.

Here's the latitude/longitude dataset for all teams:

```
[{ name: "Winnipeg Jets", latitude: 49.892892, longitude: -97.143836},
{ name: "Washington Capitals", latitude: 38.898007404102145, longitude: -77.02102392911911},
{ name: "Vancouver Canucks", latitude: 49.276586305613904, longitude: -123.11197221279144},
{ name: "Toronto Maple Leafs", latitude: 43.64329216093772, longitude: -79.37907457351684 },
{ name: "Tampa Bay Lightning", latitude: 27.94266136819524, longitude: -82.45185881853103},
{ name: "St. Louis Blues", latitude: 38.62677200283504, longitude: -90.20258724689483 },
{ name: "San Jose Sharks", latitude: 37.33274407376185, longitude: -121.90135449171066 },
{ name: "Pittsburgh Penguins", latitude: 40.439444, longitude: -79.989167},
{ name: "Phoenix Coyotes", latitude: 33.53171403984821, longitude: -112.26128339767456 },
{ name: "Philadelphia Flyers", latitude: 39.90112133861436, longitude: -75.17172664403915},
{ name: "Ottawa Senators", latitude: 45.2968034780928, longitude: -75.92723786830902 },
{ name: "New York Rangers", latitude: 40.750481718523844, longitude: -73.9935502409935},
{ name: "New York Islanders", latitude: 40.7228416889373, longitude: -73.59057247638702},
{ name: "New Jersey Devils", latitude: 40.733611, longitude: -74.171111},
{ name: "Nashville Predators", latitude: 36.15911963214768, longitude: -86.77848190069198 },
```

```
{ name: "Montreal Canadiens", latitude: 45.49591319297404, longitude: -73.56908798217773 },
{ name: "Minnesota Wild", latitude: 44.94488683641523, longitude: -93.10120761394501},
{ name: "Los Angeles Kings", latitude: 34.04303865743706, longitude: -118.26711416244507 },
{ name: "Florida Panthers", latitude: 26.15837033358863, longitude: -80.32539546489715},
{ name: "Edmonton Oilers", latitude: 53.571294635376056, longitude: -113.45601975917816},
{ name: "Detroit Red Wings", latitude: 42.32514033170812, longitude: -83.05145859718323 },
{ name: "Dallas Stars", latitude: 32.790420054007754, longitude: -96.81029230356216 },
{ name: "Columbus Blue Jackets", latitude: 39.96927220845562, longitude: -83.00610780715942 },
{ name: "Colorado Avalanche", latitude: 39.74856961976832, longitude: -105.00763803720474},
{ name: "Chicago Blackhawks", latitude: 41.88058924492546, longitude: -87.67414927482605 },
{ name: "Carolina Hurricanes", latitude: 35.803320112371956, longitude: -78.72194677591324},
{ name: "Calgary Flames", latitude: 51.03745752757153, longitude: -114.05205488204956},
{ name: "Buffalo Sabres", latitude: 42.87494984499334, longitude: -78.87632131576538 },
{ name: "Boston Bruins", latitude: 42.366281167807934, longitude: -71.06226593255996 },
{ name: "Anaheim Ducks", latitude: 33.8078150628187, longitude: -117.87654161453247 }]
```

- (50 points) Phase I: Prepare a 5-minute presentation to discuss your initial design of pseudocode on successor state generation and informed search strategies.
- (150 points) Phase II: Design and implement a hill-climbing and a simulated annealing algorithm. Report the best results identified by both algorithms, present the results in the USA map with 30 teams, 6 divisions, and 2 conferences marked up. Write a one-page report to evaluate both algorithms.

### Submission Requirements

1. Submit the one-page PPT slide and your project files and results on October 24, 2011 and November 7, 2011, respectively.
2. Your program should be well-documented. Variable names and function names should be self-descriptive. Major functions should be explained clearly in comments. The program outputs should be presented in a clear sequence.
3. Turn in the paper copy and soft copy of all the files of this assignment. Submit a single zipped file of all the files of this assignment through your UMassOnline account at <http://boston.umassonline.net/index.cfm>. Submit the paper copy along with the cover page in

class. Paper copy should be bound firmly together as one pack (for example, staple, but not limited to, at the left corner). 5 points will be deducted for unbounded homework.

4. Name your file with AI\_ lastname\_ firstname\_ pr2. For example, student John Smith should name his file as AI\_Smith\_John\_pr2\_phaseI and AI\_Smith\_John\_pr2\_phaseII.
5. No hard copies or soft copies results in 0 points.