1 Introduction and Objective

This is the last official tutorial of CS2010 this semester...

Tuesday, 10 November 2015 is Deepavali public holiday and the only Monday TA, Nathan, is also not available on Monday, 09 November 2015 as he attends ACM ICPC Jakarta 2015.

Therefore, Steven has decided to convert the 3 Monday sessions of Monday, 09 November 2015 as 3-hours of public consultation at COM1-0207 where students from T9/10/11 or any other Tuesday tutorial groups can drop by to ask questions related to CS2010. You can ask for solutions of past exam papers, provided the one who ask has shown Steven non-trivial attempt at the question.

In this last tutorial 10, we will do four important things: WQ2 debrief (max 15 minutes), discuss two harder Dynamic Programming (DP) questions, discuss the early subtasks of PS6 (short one), and end CS2010 tutorial sessions with a class photo (Jonathan’s tutorial groups will do this on Week11 instead).

DP can be challenging to master but it is an important algorithm design strategy as it can solve certain problems much more efficiently than using Complete Search. Do not hesitate to ask the teaching staffs if you encounter difficulties with this topic. You will learn more details about DP in the next core module (for CS students): CS3230 and in an optional module CS3233.
2 Tutorial 10 Questions

Written Quiz 2 Debrief

Detailed solutions will only be told to your tutor on Saturday, 31 October 2015 after Written Quiz 2.

Two Harder DP Question

Q1. A subset of vertices \( S \subset V \) is an Independent Set (IS) of graph \( G = (V, E) \) if there is no edge between any pair of them. For instance, in Figure 1, vertices \{1, 5\} form an IS, but vertices \{1, 4, 5\} do not. The largest IS in Figure 1 has size 3, e.g. \{2, 3, 6\}, \{1, 4, 6\}, or \{2, 4, 6\} (this list is not exhaustive). Give a DP solution for finding the size of the largest IS of \( G \) when \( G \) is a tree. Hint: Attach one extra Boolean parameter taken/not taken to each vertex and proceed from there. Review Lecture 11 about adding extra parameter to convert a non DAG into a DAG.

![Figure 1: A Tree](image)

Q2. Please download CS2010 Final Exam paper, 20141-15-S1-final.pdf, and solve a problem titled: Applications (25 marks) - Robot Turtles. Only one of the three sub-questions is DP, but I encourage you to read all, identify which one is DP, and try to solve all sub-questions.

Application 1: Minimum Number of ‘Move Forward’ Card(s) Used (7 marks)

1. What do the vertices and the edges of your Graph represent? (2 marks)
2. What is the upper bound of the number of vertices and edges in your Graph? (1 mark)
3. What is the Graph problem that you want to solve? (2 marks)
4. What is the best Graph algorithm to solve this problem and it’s time complexity? (2 marks)

Application 2: Minimum Number of Card(s) Used (8 marks)

1. What do the vertices and the edges of your Graph represent? (3 marks)
2. What is the upper bound of the number of vertices and edges in your Graph? (1 mark)
3. What is the Graph problem that you want to solve? (2 marks)
4. What is the best Graph algorithm to solve this problem and it’s time complexity? (2 marks)

Application 3: How Many Ways to Complete the Puzzle? (10 marks)
Problem Set 6

Now the tutor will discuss Problem Set 6, Subtask A+B only. The focus for today is to give everyone a head start for this extremely challenging last PS of this module. Your Lab TA will add a bit more on Thursday during Lab Demo 10 and then all the best...

Class Photo

As this is the last official tutorial class of CS2010, tutors are recommended to take class photos and post the photos in our CS2010 Facebook Group (Jonathan’s tutorial groups will do this on Week11 instead).

All the best for your final exam of this module and of your other modules.