

Introduction to Optimization

MS&E 111/ENGR 62, Autumn 2008-2009, Stanford University

Instructor: Ashish Goel

Homework 6. Given 11/21/08. Problems 2-4 due 12/3/08 in class. Problem 1 due 12/5/08 by email.

Collaboration policy: You can solve Problems 1 and 2 with a partner. You cannot discuss the HW with anyone not in the class.

Problem 1 [10 points]

The file blast.txt (posted on the course web page), contains four paragraphs. The first two are short descriptions of BLAST from the web. The third is a typical kind of plagiarism: some material has been deleted from paragraph 1 and then a couple of sentences have been imported from paragraph 2. The fourth is a review of the movie "Spiderman."

Using Excel, find the length of the longest common subsequence between paragraphs 1,2. Repeat for 1,3 and 1,4. For your convenience, a list of words in each paragraph (with very short words eliminated since they are usually too common to be useful) is also provided.

Since this Excel sheet will be too large to easily print, please email your solutions to kaylaqi@stanford.edu by 3:30pm on 12/5/08. If you work on this problem with a partner, only one of you needs to send the solution- just make sure that the other person's name is noted in the email.

Problem 2 [10 points] The file largemaxflow.xls (posted on the course web site), contains information on the edges of a graph. Using Excel, find the minimum cut between nodes 1 and 20.

Attach a copy of your answer report along with a brief explanation of your formulation and final answer.

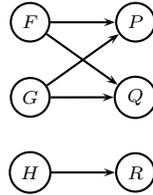
Problem 3 [10 points]

a) Create a shortest path instance where the primal (the original minimization problem we set up in class to solve this problem) is infeasible and the dual is unbounded. Clearly draw and label the network with all necessary information for a shortest path problem.

b) Find a shortest path instance where the primal is unbounded and the dual is infeasible. Again, clearly draw and label the network with all necessary information for a shortest path problem.

c) Find a shortest path instance where both the primal and dual are infeasible. Again, clearly draw and label the network with all necessary information for a shortest path problem.

Problem 4 [10 points] Consider the following network in a matching problem:



The compatibilities are:

Edge	Compatibility
FP	1.5
FQ	2.5
GP	1
GQ	2
HR	5

- (a) Write down an LP which can be solved to give the best matching between nodes F, G, H and nodes P, Q, R . Provide two optimal solutions- one that is a BFS and one that is not a BFS.
- (b) Formulate the dual of the LP in (a) and solve (either by inspection or in Excel).
- (c) Write down the complementary slackness conditions for the given primal/dual pair. Verify that these hold irrespective of which part (a) primal solution you use. Note: Since the primal constraints are equalities, there will only be complementary slackness conditions between the dual constraints and primal variables.
- (d) Provide an example primal/dual pair where, in optimality, a dual constraint is tight and the corresponding primal variable is also zero.