

This problem must be solved by you *individually*. Do not consult with any other persons in working out the solution.

Students with correct solutions will be awarded up to 5 bonus points, to be added to their test scores. All entries should be received by *April 20, 2004*.

PROBLEM #2:

A county contains two districts (Districts 1 and 2) and has two designated polling places (A and B) where individuals can vote. The number of Democrats and Republicans in each district is given in the table below. The distance (in miles) between each district and each polling place is also given below. County officials must assign each voter to a specific polling place, and this is to be done to minimize the total distance traveled by the voters to their designated polling place. However, according to state regulations, each of the polling places must have similar proportions of Democrats and Republicans assigned. Specifically, the percent of Democrats assigned to each polling place can differ by (\pm) at most 5% from the percent of Democrats in the county as a whole. Similarly the percent of Republicans assigned to each polling place can differ by (\pm) at most 5% from the percent of Republicans in the county as a whole.

	Democrat	Republican		Location A	Location B
District 1	110	260	District 1	7	9
District 2	230	250	District 2	8	6

- (a) Formulate a linear programming problem for assigning voters to polling places. Carefully define all decision variables.
- (b) Write the dual of the linear programming problem in (a).
- (c) The county manager proposes sending all voters from District 1 to polling place A, and all voters from District 2 to polling place B with the exception of 30 Democratic voters from District 2 (who are assigned to polling place A). Using *duality concepts*, verify that this is in fact an optimal assignment.