Duality (Application Problems)

1) (6.5, #29) *Meow* makes cat food out of fish and cornmeal. Fish has 8 grams of protein and 4 grams of fat per ounce, while cornmeal has 4 grams of protein and 8 grams of fat per ounce. A jumbo can of cat food must contain at least 48 grams of protein and 48 grams of fat. If fish can cornmeal both cost 5 cents per ounce, how many ounces of each should *Meow* use in each can of cat food to minimize costs? What are the shadow costs of protein and of fat?

2) (6.5, #33) The political pollster *Canter* is preparing for a national election. It would like to poll at least 1,500 Democrats and 1,500 Republicans. Each mailing to the East Coast gets responses from 100 Democrats and 50 Republicans. Each mailing to the Midwest gets responses from 100 Democrats and 100 Republicans. Each mailing to the West Coast gets responses from 50 Democrats and 100 Republicans. Mailings to the East Coast cost $40 each to produce and mail, mailings to the Midwest cost $60 each, and mailings to the West Coast cost $50 each. How many mailings should *Canter* send to each area of the country to get the responses it needs at the least possible cost? What will it cost? What are the shadow costs of a Democratic response and of a Republican response?

3) (5.5, #35) **Advertising** You are the marketing director for a company that manufactures bodybuilding supplements and you are planning to run ads in *Sports Illustrated* and *GQ Magazine*. Based on readership data, you estimate that each one-page ad in *Sports Illustrated* will be read by 900,000 people in your target group, while each one-page ad in *GQ* will be read by 500,000. You would like your ads to be read by at least 11 million people in the target group, and you plan to place at least 4 ads in each magazine. *Sports Illustrated* quotes you $400,000 per ad, while *GQ* quotes you $300,000 per ad. How many ads should be placed in each magazine to satsify your requirements at a minimum cost? What is your shadow cost per person reading your ad?