Math 20 Fall 2003
§11.8 Games of Strategy
September 26, 2003

Problem 11.8.1 (Part 1): Two competing television networks, R and C, are scheduling one-hour programs in the same time period. Network R can schedule one of three possible programs and network C can schedule one of four possible programs. Neither network knows which program the other will schedule. Both networks ask the same outside polling agency to give them an estimate of how all possible pairings of the programs will divide the viewing audience. The agency gives them each the following matrix, whose (i, j)-th entry is the percentage of the viewing audience that will watch network R if network R's program i is paired against network C's program j. Which program should your network schedule in order to maximize its viewing audience?

$$\begin{bmatrix} 60 & 20 & 30 & 55 \\ 50 & 75 & 45 & 60 \\ 70 & 45 & 35 & 30 \end{bmatrix}$$

Problem 11.8.1 (Part 2): Now suppose you have a spy at your rival network who reports that instead of airing the same show every week, your rival network might change the show it airs in that time slot from week to week. Each of its shows will air for some percentage of the weeks in the season. Your network has committed to only air the show you picked in Part 1 and has not ordered any episodes of the other shows you were considering. Should you be worried that your rival network has outmaneuvered you? Is your strategy from Part 1 still the best strategy?

Problem 11.8.1 (Part 3): Now suppose that both networks thought of the idea of changing shows from week to week. Suppose that p_i represents the probability (expressed as a decimal) that network R will air its show i in a given week, and q_j represents the probability (expressed as a decimal) that network C will air its show j in a given week. Since p_i and q_j are probabilities, it follows that

$$0 \leq p_i \leq 1 \qquad \text{and} \qquad 0 \leq q_j \leq 1$$

for $i = 1, 2, 3$ and $j = 1, 2, 3, 4$. Also,

$$p_1 + p_2 + p_3 = 1 \qquad \text{and} \qquad q_1 + q_2 + q_3 + q_4 = 1.$$

What can network R expect as its average rating for the season? Give your answer in terms of p_1, p_2, p_3, q_1, q_2, q_3, and q_4.