After a highly successful career as manager of the Fromage Cheese Company, Henry Brewster takes his fortune and buys a factory producing two major products: electric carving knives and microwave ovens.

Because of declining sales, the carving knives have been losing money recently.. In fact, during the current quarter of this year, sales will be 4 million units below the break-even point. Because the marginal revenue for each unit sold exceeds the marginal cost by $5, this situation amounts to a loss of $20 million for the quarter. Henry wants to take action quickly to rectify this situation.

He is considering two alternative courses of action. One proposal is to abandon producing the knives immediately, incurring a cost of $20 million for shutting down. The other alternative is to undertake an intensive advertising campaign to increase sales and then abandon the product (at the cost of $20 million) only if the campaign is not sufficiently successful.

Henry's marketing manager Georgia Dantzig has developed and analyzed tentative plans for this advertising campaign. It would extend over the next three quarters (subject to early cancellation). The cost would be $30 million in each of the three quarters. Georgia estimates that the increase in sales would be approximately 3 million units in the first quarter, another 2 million units in the second quarter, and another 1 million units in the third quarter.

However, because of a number of unpredictable market variables, there is considerable uncertainty as to what impact the advertising actually would have. Careful analysis indicates that the estimates for each quarter could turn out to be off by as much as 2 million units in either direction. (To quantify this uncertainty, assume that the additional increases in sales in the three quarters are independent random variables having a uniform distribution with a range from 1 to 5 million, from 0 to 4 million, and from -1 to 3 million, respectively.) If the actual increases are too small, the advertising campaign can be discontinued and the product abandoned at the end of either of the next two quarters.

Should the intensive advertising campaign be initiated and continued to its completion, Henry and Georgia estimate that the sales for some time thereafter would continue to be at about the same level as in the third (last) quarter of the campaign. Therefore, if the sales in that quarter still were below the break-even point, they would abandon the product. Otherwise they estimate that the expected discounted profit thereafter would be $40 for each unit sold over the break-even point in the third quarter.

Use dynamic programming to determine the optimal policy maximizing the expected profit.