## Question 1 (10%): Exercise 3.14

The health care manager is quite concerned about the recent deterioration of a section ofthe building that houses her urgent care operations. According to her analyst assistant,four options merit her consideration:(1) a new building, (2) major structural renovation,(3) moderate renovation, and (4) minor renovation.Moreover, three possible weatherconditions could affect the costs of fixing the building within the next six months. Goodweather condition has a probability of 0.40, moderate weather with rain has a probabilityof 0.35, and bad weather has a probability of 0.25.

If good weather materializes, option (1) will cost $215,000, option (2) will cost $120,000, option (3) will cost $90,000, and option (4) will cost $56,000. If moderate weather materializes, the costs will be $255,000 for option (1), $145,500 for (2), $98,000 for (3), and $75,000 for (4). If bad weather materializes, the costs will be $316,000 for option (1), $214,000 for (2), $123,000 for (3), and $119,000 for (4).

1. Build a payoff table.

Done in Excel.

1. Draw a decision tree for this problem. (Show cost outcomes, probabilities, and EMV for each event node.)

Done in LucidChart. Link to view chart is below

<https://lucid.app/lucidchart/invitations/accept/5a396ec3-2519-4349-a7cf-e9fa2259dd64?viewport_loc=-216.60109091454024%2C-63.48717873320835%2C1889.8509018257369%2C863.7209199750439%2C0_0>

1. Using expected monetary value (rollback procedure), which alternative should be chosen?

Expected Losses:

New Building: -$11,050.00

1. Calculate and interpret the expected value of perfect information.

## Question 2 (10%): Exercise 3.25

To guide the decision for buying a new color ultrasound for the radiology department,the **a**ttribute/alternative matrix (Table EX 3.25) has been compiled from responses to arequest for proposal(RFP).

Attribute scores reflect ratings of 1 through 10 (10 being best) with the exception of cost,

delivery time, and product’s market share.

1. Use the dominance procedure to select the supplier.
2. Use the minimum attribute satisfaction procedure to select the supplier.
3. Use the most important attribute procedure to select the supplier.

## Question 3 (10%): Exercise 4.3

Commonwealth Orthopedics, a private orthopedic practice in Newport News, Virginia, has decided to expand its physical therapy services by opening a physical therapy center. Three site options for the center are currently under consideration: (1) a property lease at Heritage Medical Park, (2) a joint venture investment in a property in Towne Center, and (3) purchase of an existing practice in East End. Average payment for physical therapy services is $90 per visit. Variable costs are projected to be $35 per visit for all locations under consideration. Fixed costs at the Heritage Medical Park are expected to be $425,000; fixed costs for the Towne Center investment are expected to be $361,608; fixed costs for the existing practice in East End are $328,302.

1. How many visits are necessary at each location to break even (realize $0 in profits)?

I used Excel Solver to find the visits to break even.

Heritage Medical Park: 7728 visits

Towne Center: 6575 visits

East End: 5970 visits

1. If expected visits are 13,700, 13,250, and 12,500 for locations A, B, and C, respectively, which location should be chosen based on total cost?

I used Excel to calculate the total costs given the expected visits.

A: Heritage Medical Park: $904,500

B: Towne Center: $825,358

C: East End: $765,802

Location C – East End should be chosen, as it has the lowest cost.

1. If expected visits are 13,700, 13,250, and 12,500 for locations A, B, and C, respectively, which location should be chosen based on total profits?

I used Excel to calculate the total profits given the expected visits.

A: Heritage Medical Park: $328,500

B: Towne Center: $367,142

C: East End: $359,198

Location B – Towne Center should be chosen, as it has the highest total profits

1. Determine the sensitivity of the decision in part (c) to a +/–20 percent fluctuation in visits.

Done in Excel.

Price Sensitivity = (Change in Quantity Purchased / Change in Price) \* 100%

The sensitivity is 1.82% for a +/– 20% fluctuation in visits.

## Question 4 (30%)

As a manager considers to 5 potential warehouses to store medical supply materials in order to cover the demand of the 10 hospitals in the area. The geographical information is provided in the attached Excel file. The demand of hospitals and the capacity and setup cost of warehouses are also provided. If you were the manager, how will you make decisions for the following plans? Develop and solve mathematical optimization models accordingly to provide resulting information to support your decisions.

1. How to determine the assignment of hospitals to warehouses by only considering minimum travel distance regardless of demand. A warehouse could cover more than one hospital.

w1: ['H4', 'H6', 'H9', 'H10', 'H13', 'H16', 'H20'],

w2: ['H2', 'H5', 'H11', 'H12', 'H18'],

w3: ['H3', 'H15', 'H19'],

w4: ['H7', 'H8'],

w5: ['H1', 'H14', 'H17']

1. Now only two warehouses can be installed among 5 potential locations to cover the demand of 10 hospitals maximally within a minimum distance. Which two locations will be the best choice regardless of setup cost? And what is assignment plan?

w3, w4

w3: H4, H5, H6, H7, H8, H9, H10, H13, H16, H20

w4: H1, H2, H3, H11, H12, H14, H15, H17, H18, H19

1. Regardless of warehouse capacity, what is development plan including how many warehouses to install and hospital assignment?

w3, w4

same as above

Note: you are required to use Python/Gurobi or equivalent packages for this question.

Did this in Python.

## Question 5 (10%): Exercise 10.8

A regional laboratory that performs nontraditional tests is planning to offer new diagnostic tests for regional hospitals. Current analyzers and staff are capable of performing these tests. The laboratory manager assessed the required staff and analyzer times, as well as the chemical materials required for a bundle of fifty vials for each type of test listed in Table EX 10.8.

1. Formulate this as a linear programming problem.

xn: number of tests for Type ‘n’

Objective Function: Maximize Profit, P = 8x1 + 10x2 + 8x3 + 7x4 + 10x5

Subject To:

15x1 + 15x2 + 15x3 + 20x4 + 25x5 <= 3,400

20x1 + 40x2 + 40x3 + 60x4 + 45x5 <= 6,000

12x1 + 15x2 + 16x3 + 14x4 + 14x5 <= 2,700

x1, x2, x3, x4, x5 >= 0, are integers

1. Solve the problem using Excel Solver.

Done in Excel.

1. For the optimal solution, in terms of profit, which test(s) should be offered?

Tests Types I, II, and V should be offered.

1. What is/are the optimal volume(s)?

120 (Test I) + 56 (Test II) + 30 (Test V) = 206 tests

1. What is the total expected profit from the new tests?

$1,820

1. Which resources should be expanded?

Materials, we should expand the resources for all of the materials, but materials have the smallest capacity out of the three resources.

1. How much additional revenue can be expected if the resources are selected in part (f) for expansion without violating the current solution?

Revenue goes up to $1956 if you increase the materials to 2,934 or anything above.

## Question 6 (xx%)

TBD

## Question 7 (xx%)

TBD

## References