

Antoine Rocha
M.O.T 1 HW#4

Homework # 4

Schedule:

Review the homework -(5 minutes)
Brainstorm-(5 minutes)
Work on structure problem solving (120 minutes)
Define the problem (5 minutes)
Plan the treatment of the problem(10 minutes)
Execute the plan(30 minutes)
Check your work(10 minutes)
Learn and generalize(20 minutes)
Total time (200 minutes)

Problem 1:*Research & Development*

Define the problem:

Jackson Pharmaceuticals Inc. is considering funding a research team to cure Some disease. Bill Mackenzie, executive VP of research, must ultimately make this decision. The research program has a total price tag of \$10 million (M), and there is no guarantee that it will be successful. In fact, Bill estimates only a 40% chance that they will find a cure. If the research team finds a cure, Jackson Pharmaceuticals must then decide whether they wish to produce the drug themselves or sell the license to a chemical lab for (a revenue of) \$40M. If they produce the product themselves and production goes smoothly, they forecast a revenue of \$60M. But refitting one of their production facilities can be troublesome. There is a 30% chance of production troubles, in which case they would earn only \$20M revenue.

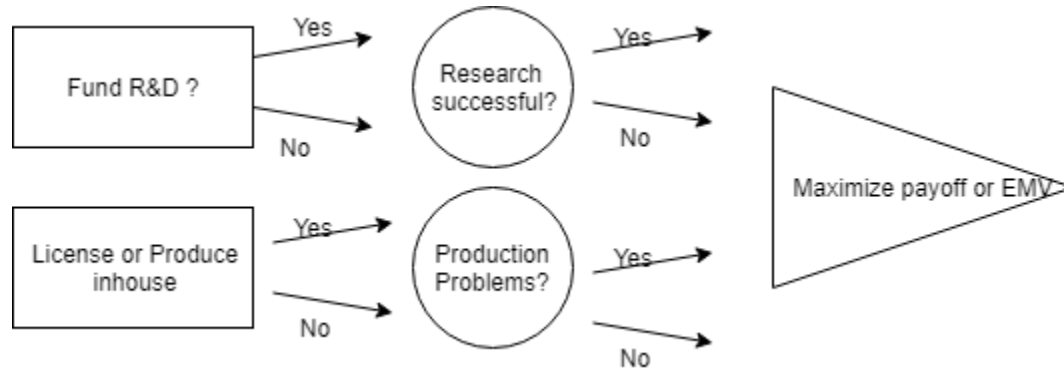
- 1) What should Bill McKenzie do ? (Result: Expected Monetary Value or payoff from a successful R&D project = 9.2M).
- 2) How do you think the probability, cost, and revenue information used in this analysis were obtained?

Plan the treatment of the problem:

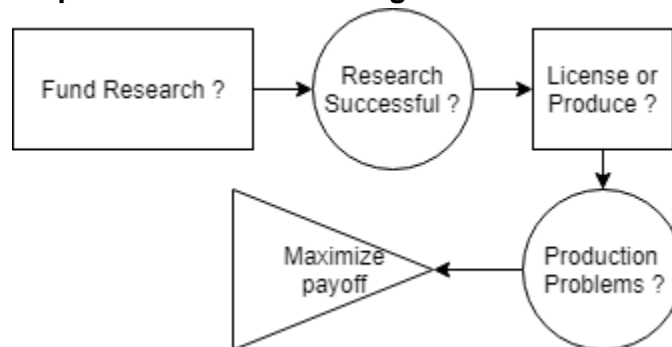
- 1) Define all questions that needed to be answered
- 2) Go over notes
- 3) List building blocks
- 4) Create influence diagrams
- 5) Do Decision analysis
- 6) Choose best option
- 7) Execute

Execute the Plan :

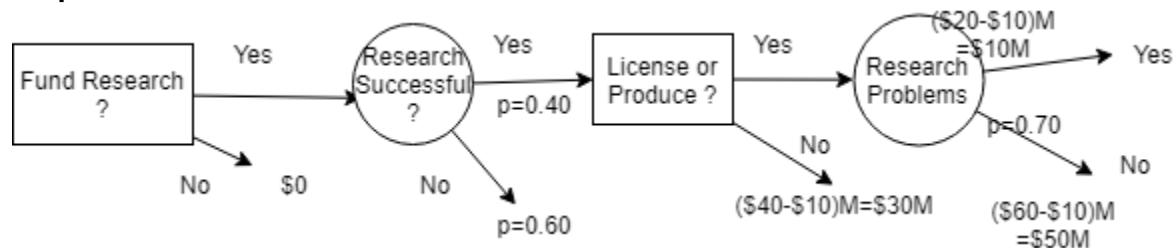
Step 1: List all the building blocks



Step2: Create influence diagram



Step 3: Create the decision tree



Step 4: Calculate payoffs and maximize values

Choice 1) Fund the research ?

Funding research = \$9.2M

Not funding research = \$0

Choice 2) Research successful ?

Successful = $(0.40)(38) + (0.60)(-10) = \9.2

Not successful = -\$10M

Choice 3) License or produce?

Produce = \$38M

Sell license = \$30M

Choice 4) Research problems ?

No Problems = $(0.70)(50) + (0.30)(10) = \$38M$

Problems = \$10M

Step 5: Answer questions and draw conclusions

i) what should Bill Mckenzie do?

After analyzing all the decisions and the possible results of whether to proceed to the next step or not, I can say that there may be some risk but overall it is better to go through each stage since it may yield a higher profit.

ii) How do you think that the Jackson Pharmaceuticals obtained the probability values used in the analysis ?

Jackson Pharmaceuticals could have obtained the probability value from a previous research which is given in this problem.

Step 6: sensitivity analysis?

Although this question does not ask for a sensitivity doing so will allow to get more concrete understanding of which direction to take with the research project. When the stakes are higher , the margin of error and robustness of the decision is critical. Doing something like a sensitivity analysis will help make a better decision.

Check the work:

Even though the decision tree is accurate, the fact that probabilities change within a moments notice, and they are not accurate. In real time, a decision tree can only foreshadow a few possible outcomes, and that is what we done. By no means this is not the only possible outcomes. With this set of probabilities the variable are enumerable. Having said that,that work that is done above does justice to the information that was given.

Learn and Generalize:

Through using the structured approach, and identifying each possible outcome and which one yields the highest return value I have managed to come to the decision and following through on that decision that took all most of the variables into account will yield me the highest and best possible outcome.

Problem 2: Should pharma C, invest in product development of compound X ?

Define the problem:

If a cure can be developed for Some Horrible Disease (SHD), it would be beneficial to humankind and yield a profit of \$500M. Initial research indicates a 25% chance that a partial compound X will be effective against SHD. However it will require an additional \$25M in R&D to know for sure. Furthermore, even if the resulting compound is proven effective, an additional \$25M in testing will be required to get it approved for use in humans. It is estimated that there is a 40% chance that the testing will reveal serious side effects and approval will be denied.

As SHD's project director you are concerned with 2 principal issues.

First, should you pursue the commercial development of compound X?

Second, if you do pursue development, what value should you place on the project when comparing it to competing projects?

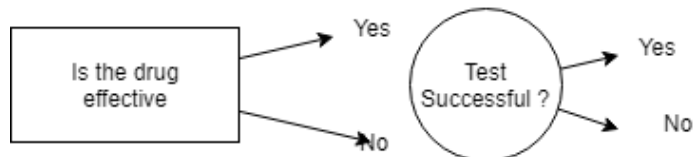
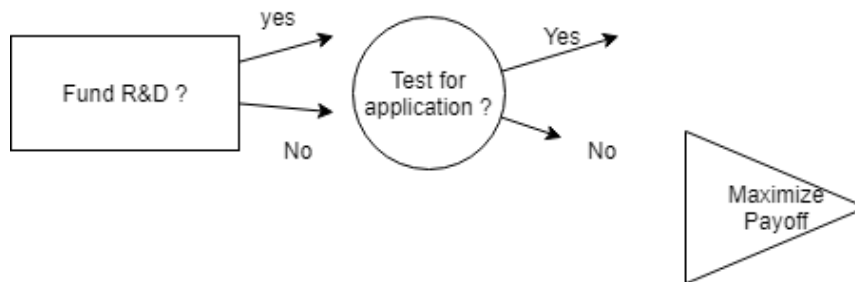
Perform a sensitivity analysis on your results.

Plan the treatment of the problem:

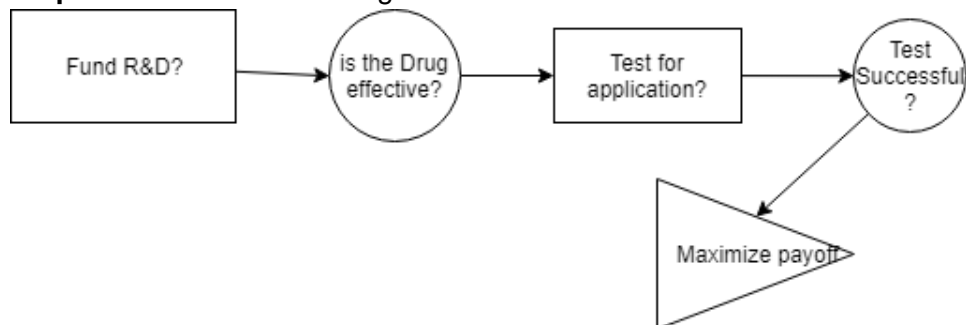
- 1) Define all questions that needed to be answered from the problem
- 2) Go over notes from class on October 28th on how to approach this problem
- 3) List building blocks
- 4) Create needed influence diagrams
- 5) Create decision trees that are needed
- 6) Calculate payoffs and maximize values
- 7) Choose best option
- 8) Execute
- 9) Draw conclusions and answer questions to the problem

Execute the plan:

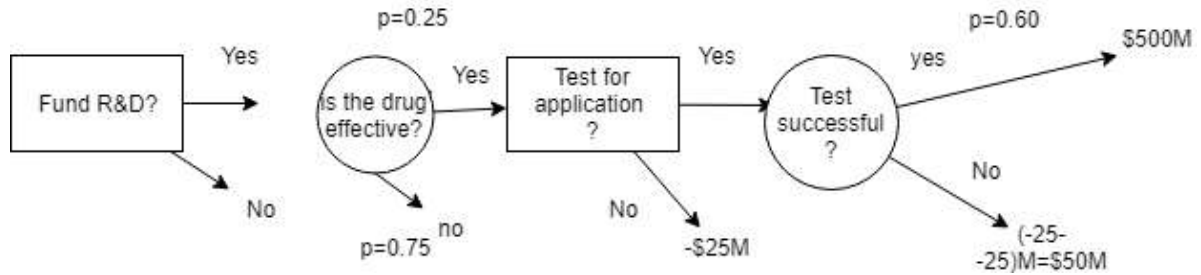
- 1) **Step 1:** List all building blocks



- 2) **Step 2:** Create influence diagram



- 3) **Step 3:** Create the decision tree



4) **Step 4:** Calculate payoffs and maximize value

Choice 1) Funding R&D ?

Funding R&D = \$51.25M

Not Funding Research = \$0

Choice 2) Drug Effective ?

Effective = $(0.24)(280) + (0.75)(-25) = \$51.25M$

Not Effective = -\$25M

Choice 3) Test for Application

Test = \$280M

No = -\$25M

Choice 4) Research problems?

No problems = $(0.60)(500) + (0.40)(-50)M = \$280M$

Problems = -\$50M

5) **Step 5:** Answer problems and draw conclusions

1 Should you pursue the commercial development of compound X?

After analysing all the decisions and the possible results of whether to proceed to the next step or not, There are some risk, but overall it's better to take on each decision since it will yield a higher profit.

Step 6: do a sensitivity analysis to determine the robustness of the decision

To calculate the value of p we need to take the values from the first undetermined event in terms of p: $(500)(1-p) + (-50)(p) = 500 - 550p$ and we take values from the second undetermined event in terms of p: $(280)(p) + (-25)(1-p) = 305p - 25$. And we set them equal to each other: $500 - 550p = 305p - 25$ and solve for p which equals 0.614 or 61.4%

When $p < 61.4\%$ -> Don't invest in research (the cost of YES decision is higher)

When $p > 61.4\%$ -> Invest in research (Cost of no decision is higher)

If $p = 61.4\%$ the cost of both decisions are the same

Decision 1	Pnom is 60% -> Don't invest
Decision 2 +10% variation	$.6 + .1(.6) = 66\% \rightarrow$ Invest
Decision 3 -10% variation	$.6 - .1(.6) = 54\% \rightarrow$ Don't Invest

Decision 4 +20%variation	$.6 + .2(.6) = 72\%$ -> Invest
Decision 5 -20% variation	$.6 - .2(.6) = 48\%$ -> Don't Invest

Step 7: Should the compound be developed commercially ? second if it is what value should be placed on the project

After viewing the rollbacks it is obvious that there is risk involved with the probabilities that we have been given, going ahead with each stage of the process will still yield a higher profit in return. Given, the probabilities that we have the compound developed commercially, However, the sensitivity analysis to see robustness of the decision and viewing the marker it is obvious that the probability of success and failure can fluctuate.

Check the work:

Even though this decision Tree is accurate, the fact that probabilities can change they are inherently not accurate, in real time a decision tree can only foreshadow a few outcomes. However any change can have a direct impact on the success of the program.

Learn and generalize:

After using the structured problem solving for the past few problems, I have learned to use it properly each time. As a result, I have managed to come up with smarter and accurate decisions.