Spreadsheet Modeling and Decision Analysis 9th edition Ragsdale Solutions Manual

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Chapter 1
Introduction to Modeling and Decision Analysis

1. Decision Analysis: Identifying and evaluating the different possible courses of action that might be chosen to address a decision problem.

2. Computer Model: A set of mathematical relationships and logical assumptions implemented in a computer as a representation of some real-world object or phenomenon.

3. A spreadsheet model is a type (or special case) of a computer model where a spreadsheet is used to implement the model.

4. Business Analytics: A field of study that uses computers, statistics, and mathematics to solve business problems.

5. Many of the tools and techniques from the field of business analytics can be implemented and used in spreadsheets.

6. Spreadsheets are sometimes used to store lists of data, such as the grades of students in a class, or names, addresses, and phone numbers of friends and family. These types of "database" applications of spreadsheets do not fall into the area of business analytics unless the data is being "mined" with a specific objective in mind.

7. Spreadsheets facilitate the decision-making process by making it easier to play out various what-if scenarios.

8. A modeling approach to decision making is beneficial in that the decision maker can analyze the probable impact of numerous alternative before selecting an alternative for implementation.

9. Dependent Variable: A bottom-line performance measure of interest to the decision maker that is influenced by other variables in the model; denoted by the symbol Y in the expression $Y = f(X_1, X_2, ..., X_3)$.

10. Independent Variable: A variable that influences (or plays a role in determining) the value of some bottom-line performance measure (dependent variable); denoted by the symbols X_i in the expression $Y = f(X_1, X_2, ..., X_3)$.

11. Yes, a model can have more than one dependent variable. In some decision problems, a manager might be interested in evaluating various alternatives on the basis of profit, probable number of injuries, resulting amount of toxic waste produced, etc. Each of the variables represents a bottom-line performance measure that the manager might be interested in that should be included in the model.

12. Yes. See the answer to the previous question.

13. Several of the models used in predictions surrounding the COVID-19 pandemic in 2020 turned out to be wrong but provided useful guidance in actions that saved many lives.
See: https://www.kunc.org/health/2020-04-07/all-models-are-wrong-but-some-are-useful-what-covid-19-predictions-can-and-cant-tell-us#stream/0

14. The solution to prescriptive models tells managers what actions to take while descriptive models simply describe the operation of a system. In descriptive models, the values to be assumed by one or more independent variables are uncertain and not under the decision maker's control.

15. The solution to prescriptive models tells managers what actions to take while predictive models provide forecasts of what will happen in the future. In predictive models, the functional form $f()$ describing the nature of the relationship between the dependent and independent variable is ill-defined or not precisely known.

16. Descriptive models have a well-defined functional form, but the values of one or more of the independent variables are unknown or uncertain. In predictive models, the values of the independent variables are known or under the decision maker's control, but the functional form $f()$ describing the nature of the relationship between the dependent and independent variables is ill-defined or not precisely known.

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17. Description: To report on or summarize the features, characteristics, or behavior of some object or phenomenon.

Prediction: An estimate or forecast of what will occur in the future.

Prescription: Directions, orders, or advice on how to solve a problem.

18. Consider the problem of determining how to travel from your home to school or work. There are probably many different routes that could be taken that might influence the total distance (or total length of time) required for the trip. Most people would be interested in determining the route that requires the least distance (or least amount of time). In this sort of problem (also known as a shortest path problem) the different routes that can be chosen represent independent variables, and the dependent variable would be the total distance (or total travel time).

19. The spreadsheet in Figure 1.2 most closely resembles a prescriptive model because the function form $f()$ relating the dependent and independent variables is well-defined and the values of the independent variables are known, or are under the decision maker's control.

20. "Probortunity" is the combination of the words "problem" and "opportunity" and denotes the fact that every problem can also be viewed as an opportunity.

21. The steps in the problem-solving process are:

a. Identify the problem
b. Formulate and implement a model
c. Analyze the model
d. Test the results of the model
e. Implement the solution

22. All of the steps are important but identifying the correct problem is probably the most important one. If we fail to identify the correct problem, all the effort expended in solving the problem will be wasted.

23. No. A model must accurately represent only the relevant details of a decision problem.

24. The simplest model that provides accurate solutions is usually the best choice.

25. Advertisers commonly manipulate decision making to increase consumer's expectations regarding price. For instance, a national fast food chain recently undertook an ad campaign describing a "$6.00 hamburger" that could be purchased in their restaurants for "only" $2.95.

The most common anchor is the status quo. Individuals and committees tend to rely on the last or current values of costs or time-to-complete projects to decide on the allocations of resources to those projects. These estimates are usually unrealistically optimistic.

26. Sales people often frame the cost of purchasing an item so that it appears it is "…just pennies a day!"

In the legal realm, defense attorneys tend to frame jury awards as a gain: "How much should the defendant have to pay to make the plaintiff whole again?" whereas plaintiff's attorneys favor a loss frame: "How much would you have to be paid to suffer an injury like the harm done to my client?"

One tends to get different answers from the same person on the issue of abortion by framing the problem in the following ways: "Are you in favor of killing innocent unborn children?" versus "Should a woman be able to decide what happens to her own body?"

27. Here, both people venturing into the ocean probably made bad decisions. This example should underscore the point that the outcome does not determine the quality (goodness or badness) of the decision.

28. It might be worth noting that students are more likely to identify good decisions that resulted in bad outcomes rather than bad decisions that resulted in good outcomes because bad outcomes tend to make the headlines.

- Jimmy Carter's decision to attempt to rescue the American hostages held in Iran in the early 1980s, arguably, could have been a good decision that resulted in a bad outcome.
- The movie Forest Gump is replete with examples of bad (seemingly illogical) decisions that results in good outcomes.

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- Airline pilots have undoubtedly made bad decisions to take-off or land in unsafe weather conditions without suffering a bad outcome.
- In 2020, various governments around the world had to make hard decisions about the COVID-19 pandemic, some of which were undoubtedly good but resulted in poor outcomes, and some of which were bad decisions that resulted in good outcomes.

Case 1.1: Patrick's Paradox

Josh is correct. Peyton's calculation is correct if there are exactly 21 "good" returns and 9 "bad" returns. But "good" returns are more likely than "bad." While Peyton's calculation seems to account for this, it underweights the returns that would occur if more than 21 "good" returns occur, which is more likely to happen than having more than 9 bad returns.

The underlying probability mechanism in this problem is the binomial distribution—which is appropriate for modeling situations where a series of random trials are independent and each have an equal probability of "success." So in this problem, in each of 30 years you can observe either a 17.5% return (and let's call that a "success" or a –7.5% return (and let's call that a "failure"). Of course, there is a 0.7 probability of "success" in any year (and a 1 – 0.7 = 0.3 probability of "failure").

In Excel, the function =Binomdist(s, n, p, True) returns the CUMULATIVE probability of "s" successes in "n" trials where each trial has a "p" probability of success. So, for example, =Binomdist (21, 30, 0.7, True) returns 0.5684, indicating there is a 0.5684 probability of having from 0 to 21 "successes" (or 21 or fewer "successes") out of 30 trials. So what is the probability of 21 or more "successes" in this problem? That would be =1 – Binomdist(21, 30, 0.7, True) = 1 – 0.5684 = 0.4315. And what is the probability of more than 9 "failures" in this problem? That would be =1 – Binomdist(9, 30, 0.3, True) = 1 – 0.5888 = 0.4111.

That is why I say, "While Peyton's calculation seems to account for this, it underweights the returns that would occur if more than 21 'good' returns occur, which is more likely to happen than having more than 9 bad returns."

Of course, the real point of this problem is not how much money Patrick might have and whether Josh is correct or Peyton is correct. The real point is this: Is this problem easier or more difficult than the problems we face in business? Are the decision alternatives we face in business as clearly defined and precise as the alternatives here? I think the answer to both of these questions is "Probably not." So, if we can get confused and have trouble discerning the proper answer to a relatively easy decision problem with clear alternatives in a problem like this, how likely are we to get the "right" answers for the more complicated decision problems we face in the real world using (only) our own judgment and brain power? So, the moral of this story and lesson is here that there could be some ways in which quantitative modeling of decision problems might help us to make better decisions than relying on judgment alone.

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