Chapter 1—Introduction to Modeling

MULTIPLE CHOICE

1. Which of the following is a type of model that is key to virtually every management science application?
    a. Heuristic model
    b. Queuing model
    c. Mathematical model
    d. Regression model

    ANS: C   PTS: 1   NAT: AACSB: Analytic

2. Which of the following is _not_ one of advantages of mathematical models?
    a. Mathematical models enable managers to understand the problem better
    b. Mathematical models allow analysts to employ a variety of mathematical solution procedures
    c. The mathematical modeling process itself, if done correctly, often helps "sell" the solution
    d. Mathematical models help reduce the cost of obtaining a solution

    ANS: D   PTS: 1   NAT: AACSB: Analytic

3. Before trusting the answers to what-if scenarios from a spreadsheet model, a manager should attempt to:
    a. validate the model
    b. make sure all possible scenarios have been investigated
    c. check the mathematics in the model
    d. sense-check the model

    ANS: A   PTS: 1   NAT: AACSB: Analytic

4. Optimization models are useful for determining:
    a. sensitivity to inputs
    b. whether the inputs are valid or not
    c. what the manager should do
    d. the value of the output under the current conditions

    ANS: C   PTS: 1   NAT: AACSB: Analytic

5. Management science has often been taught as a collection of:
    a. theories
    b. problems
    c. models
    d. topics

    ANS: C   PTS: 1   NAT: AACSB: Analytic

6. The modeling process discussed in _Practical Management Science_ is a
    a. seven-step process
    b. six-step process
    c. five-step process
    d. four-step process

    ANS: A   PTS: 1   NAT: AACSB: Analytic

7. Defining an organization's problem includes:
   a. specifying the organization's objectives
   b. collecting the organization's historical data
   c. defining the model of the problem
   d. sensitivity analysis

   ANS: A   PTS: 1   NAT: AACSB: Analytic

8. Which of the following type of model is used when an appropriate equation or system of equations can be developed to represent the system?
   a. Simulation model
   b. Analytical model
   c. Heuristic model
   d. Spreadsheet model

   ANS: B   PTS: 1   NAT: AACSB: Analytic

9. A first step in determining how well a model fits reality is to:
   a. check whether the inputs are correct
   b. see if the sensitivity analysis is correct
   c. check whether the model is valid for the current situation
   d. try some what-if scenarios to see if the model is able to obtain solutions

   ANS: C   PTS: 1   NAT: AACSB: Analytic

10. Which of the following is *not* necessarily a property of a good model?
    a. The model represents the client's real problem accurately
    b. The model is as simple as possible
    c. The model is based on a well-known algorithm
    d. The model is one the client can understand

    ANS: C   PTS: 1   NAT: AACSB: Analytic

11. Which of the following is a possible cause if a model's outputs for certain inputs are not as expected?
    a. The certain inputs may not be correct
    b. The model could be too detailed of an approximation of the actual situation
    c. The mathematics in the model might be incorrect
    d. The expected outputs are not correct

    ANS: D   PTS: 1   NAT: AACSB: Analytic

12. Which of the following is *not* one of the guiding principles for a heuristic?
    a. Common sense
    b. Intuition
    c. Trial and error
    d. Optimality

    ANS: D   PTS: 1   NAT: AACSB: Analytic

13. Which of the following is *not* one of the desired conditions for a successful model implementation?
    a. The people who will run the model understand how to enter appropriate inputs
    b. The people who will run the model are able to run what-if analysis
    c. The people who will run the model are able to modify it
    d. The people who will run the model are able to interpret the model's outputs correctly

ANS: C   PTS: 1   NAT: AACSB: Analytic

14. The most frequent cause of a failed implementation of a model is:
    a. the model is incorrect
    b. the analyst fails to communicate how to use the model
    c. the data for the model is unavailable
    d. the model is too complex

    ANS: B   PTS: 1   NAT: AACSB: Analytic

15. Which of the following is *not* one of the reasons for the new-found relevance of management science models?
    a. Modeling is an important way to think about problems in general
    b. Modeling is often now a legal requirement
    c. The business world is increasingly driven by numbers
    d. Modeling helps develop intuition for problems

    ANS: B   PTS: 1   NAT: AACSB: Analytic

TRUE/FALSE

16. Models that suggest a desirable course of action are called descriptive models

    ANS: F   PTS: 1   NAT: AACSB: Analytic

17. In a descriptive model, the manager first wants to build a model that reflects the current situation.

    ANS: T   PTS: 1   NAT: AACSB: Analytic

18. In modeling situations where it is not possible to write an equation for an output in terms of the inputs, there may still be a mathematical procedure for calculating outputs from inputs.

    ANS: T   PTS: 1   NAT: AACSB: Analytic

19. One of the advantages of spreadsheet models is that they allow managers to ask what-if questions.

    ANS: T   PTS: 1   NAT: AACSB: Analytic

20. One of the arguments that management science practitioners have used to criticize the emphasis on specific models is that they do not provide the correct answer.

    ANS: F   PTS: 1   NAT: AACSB: Analytic

21. The overall modeling process typically done in practice always requires seven steps: define the problem, collect and summarize data, develop a model, verify the model, select one or more suitable decisions, present the results to the organization, and finally implement the model and update it through time.

    ANS: F   PTS: 1   NAT: AACSB: Analytic

22. Modeling is a process where the essence of a theoretical problem is extracted into a model, spreadsheet or otherwise.

ANS: F	PTS: 1	NAT: AACSB: Analytic

23. In some applications, an analyst might present several alternative solutions from a model, and let the organization choose the best one.

    ANS: T	PTS: 1	NAT: AACSB: Analytic

24. A management science model is typically initiated when an organization believes it has a problem.

    ANS: T	PTS: 1	NAT: AACSB: Analytic

25. Data are often not in the required form, in which case it is the analysts' job to gather the right data and put it into an appropriate format.

    ANS: T	PTS: 1	NAT: AACSB: Analytic

26. A good model should achieve the right balance between being too simple and too complex.

    ANS: T	PTS: 1	NAT: AACSB: Analytic

27. Verification is typically the most difficult phase of the modeling process, from a mathematical perspective.

    ANS: F	PTS: 1	NAT: AACSB: Analytic

28. As models become larger and more complex, heuristic solutions are often adequate, even though they are not necessarily optimal solutions.

    ANS: T	PTS: 1	NAT: AACSB: Analytic

29. The best strategy for implementation of a model is to involve key people in the organization in the project when the model is ready for testing and verification.

    ANS: F	PTS: 1	NAT: AACSB: Analytic

30. A completed model typically marks the end of the modeling process.

    ANS: F	PTS: 1	NAT: AACSB: Analytic

Probability

0.3	500	Low Sales
0.5	750	Medium Sales
0.2	1000	High Sales

Order	Net Profit
	$4,200

#21   725 Expected Sales

500	3500
600	4200

600 Order   #24 | 700 | 4900 |

800	4850
900	4550
1000	4250

$5 Unit cost
$12 Unit sales price
$2 Unit salvage value

#22 $7,200 Revenue
$3,000 Cost
$0 Salvage
#23

$4,200 Net Profit

	Order	Net Profit
		$4,200
	600	4200
	650	4550
	700	4900
#25	750	5000
	800	4850

		1	2	3	4	5
Units Sold Growth Rate	10%					
Variable Cost Rate	$15 per unit produced					
Discount Rate	8%					
Year		1	2	3	4	5
Units Produced		200	220	242	266.2	292.82
Price		$20.00	$22.00	$25.00	$28.00	$31.50
Var. Cost		$3,000	$3,300	$3,630	$3,993	$4,392
Fixed Cost		$500	$500	$500	$500	$500
Net Cash Flow		$500.00	$1,040.00	$1,920.00	$2,960.60	$4,331.53

Up-front Investment   ($2,000)

Net Present Value $6,002.85 #26

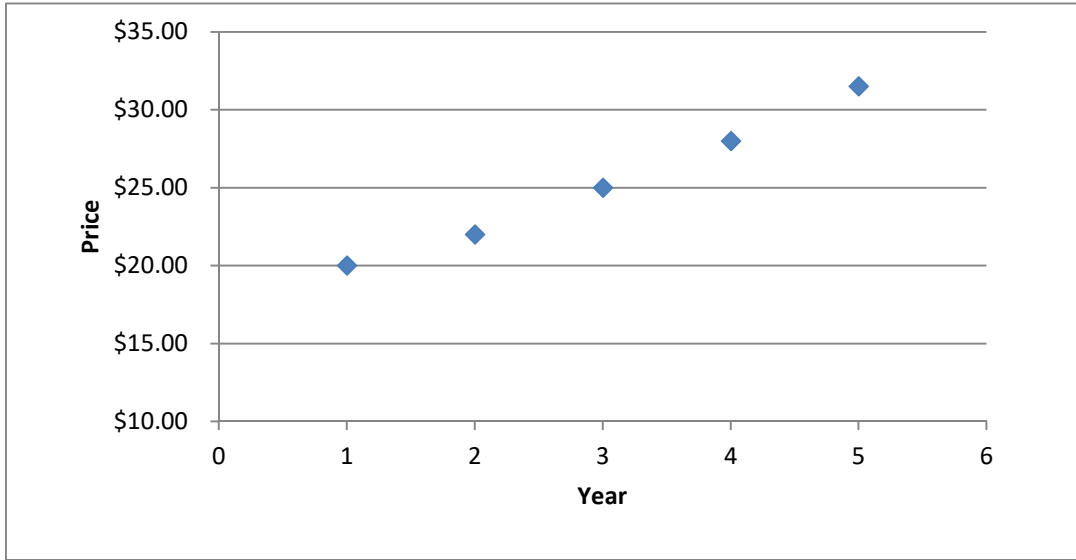Trendlines
Linear
Intercept   16.6
Slope   2.9

Exponential
Constant   17.684
Exponent   0.115

Growth rate to achieve $10,000 NPV   24.6% use Goal Seek   #27

Variable cost rate to achieve $10,000 NPV $10.84 use Goal Seek   #28

	Year				
	1	2	3	4	5
Forecast	$19.50	$22.40	$25.30	$28.20	$31.10
Abs. % Err	2.50%	1.82%	1.20%	0.71%	1.27%

1.50% MAPE   #29

Forecast	$19.84	$22.26	$24.97	$28.01	$31.43
Abs. % Err	0.80%	1.17%	0.12%	0.05%	0.23%

0.47% MAPE   #30