The Notre Dame Code of Honor is in force or this examination.

First Midterm Examination Spring 2006

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question. Please answer all questions on the answer sheet provided.

There are 50 multiple choice questions; each multiple choice question is worth 1.4% of the total grade on the exam.

There are three essay questions (question numbers 51, 52, and 53); each essay question is worth 10% of the total grade on the exam.

____ 1. Which subjective forecasting method depends upon the anonymous opinion of a panel of individuals to generate sales forecasts?
   a. Sales Force Composites.
   b. Customer Surveys.
   d. Delphi Method.
   e. None of the above.

____ 2. Which subjective sales forecasting method may have the most information about the spending plans of customers for a specific firm?
   a. Sales Force Composites.
   b. Index of consumer sentiment.
   d. Delphi Method.
   e. None of the above.

____ 3. Which subjective sales forecasting technique may have problems with individuals who have a dominant personality?
   a. Sales Force Composites.
   b. Customer Surveys.
   d. Delphi Method.
   e. None of the above.

____ 4. Which of the following is not considered a subjective forecasting method?
   a. Sales force composites.
   b. Naive methods.
   c. Delphi methods.
   d. Juries of executive opinion.
   e. Consumer surveys.
5. Forecasts based solely on the most recent observation(s. of the variable of interest
   a. are called “naive” forecasts.
   b. are the simplest of all quantitative forecasting methods.
   c. leads to loss of one data point in the forecast series relative to the original series.
   d. are consistent with the “random walk” hypothesis in finance, which states that the
      optimal forecast of today's stock rate of return is yesterday's actual rate of return.
   e. All the above.

6. Which of the following measures of forecast accuracy can be used to compare “goodness of fit”
   across different sized random variables?
   a. Mean Absolute Error.
   b. Mean Absolute Percentage Error.
   c. Mean Squared Error.
   d. Root Mean Squared Error.
   e. None of the above.

7. Which measure of forecast accuracy is analogous to standard deviation?
   a. Mean Absolute Error.
   b. Mean Absolute Percentage Error.
   c. Mean Squared Error.
   d. Root Mean Squared Error.

8. What values of Theil’s U statistic are indicative of an improvement in forecast accuracy relative to
   the no-change naive model?
   a. U < 0.
   b. U = 0.
   c. U < 1.
   d. U > 1.
   e. None of the above.

9. RMSE applied to the analysis of model forecast errors, treats
   a. levels of large and small forecast errors equally.
   b. large and small forecast errors equally on the margin.
   c. large and small forecast errors unequally on the margin.
   d. every forecast error with the same penalty.

10. Because of different units of various data series, which accuracy statistic can be used across different
    series?
    a. MSE.
    b. RMSE.
    c. Theil’s U statistic.
    d. MAE
    e. None of the above.
11. Which of the following is not an appropriate use of forecast errors to assess the accuracy of a particular forecasting model?
   a. Examine a time series plot of the errors and look for a random pattern.
   b. Examine the average absolute value of the errors.
   c. Examine the average squared value of the errors.
   d. Examine the average level of the errors.
   e. None of the above.

12. When using quarterly data to forecast domestic car sales, how can the simple naive forecasting model be amended to model seasonal behavior of new car sales, i.e., patterns of sales that arise at the same time every year?
   a. Forecast next period's sales based on this period's sales.
   b. Forecast next period's sales based on last period's sales.
   c. Forecast next period’s sales based on the average sales over the current and last three quarters.
   d. Forecast next period's sales based on sales four quarters ago.
   e. None of the above.

13. According to the *Wisdom of Crowds*,
   a. our imperfect judgements rarely aggregate in the right way.
   b. all crowds are wise.
   c. groups can never be smarter than the smartest people in them.
   d. the worst performing investment clubs in the United States consist of people who like one another, socialize together, and show consensus.

14. According to the *Wisdom of Crowds*, on the television show *Who Wants To Be A Millionaire?* which of the following is correct?
   a. Polling the studio audience has given the correct answer 91% of the time.
   b. Calling an expert elicited the correct answer almost 95% of the time.
   c. Contestants who used neither an audience poll nor an expert telephone call were more successful than contestants who used one or both techniques.
   d. None of the above is correct.

15. Forecasting January sales based on the previous month's level of sales is likely to lead to error if the data are _____.
   a. Stationary.
   b. Non-cyclical.
   c. Seasonal.
   d. Irregular.
   e. None of the above.

16. When a time series contains no trend, it is said to be
   a. nonstationary.
   b. seasonal.
   c. nonseasonal.
   d. stationary.
   e. filtered.
17. When the correlation coefficient is negative, it means:
   a. there is a weak relationship.
   b. when X goes down, Y does too.
   c. X will not be a good predictor of Y.
   d. when X goes down, Y tends to go up.
   e. None of the above.

18. In the "Against All Odds" lecture on cycles and trends, Professor Amabile told of her driving times to work at the university each day. The data she used was
   a. a time series.
   b. cross sectional data.
   c. non numeric data.
   d. ordinal data.

19. In the "Against All Odds" lecture on cycles and trends the example explaining the use of "bright light therapy" examined what statistical concept?
   a. body temperature
   b. internal clocks
   c. trends
   d. cycles
   e. both c and d above

20. In the "Against All Odds" lecture on cycles and trends the period of a cycle was
   a. the vertical distance between peaks of the cycle.
   b. the vertical distance between the peak of a cycle and the trough of a cycle.
   c. the horizontal distance between the peak of a cycle and the trough of a cycle.
   d. the horizontal distance between peaks of a cycle.

21. In the "Against All Odds" lecture ozone levels in the upper atmosphere were examined statistically. The scatter exhibited
   a. both trend and seasonality.
   b. only trend.
   c. only seasonality.
   d. a random pattern (i.e., no trend or seasonality).

22. In the "Against All Odds" lecture on trend and seasonality the "surprise response" was studied.
   a. The techniques used was smoothing.
   b. The technique used was a moving average.
   c. The researchers were looking for a cycle.
   d. The researchers were looking for a trend.

23. In the "Against All Odds" lecture on cycles and trends Burton Malkiel (Yale University) indicated that
   a. there are long run cycles in stock prices.
   b. there are no trends in stock prices.
   c. stock prices seem to follow a random walk.
   d. diversification of stock holdings is not in an investor's best interest.
   e. Both b and c above are correct.
When examining the 1970 Draft Lottery we used Holt's Exponential Smoothing to model the draft order data. The plot from that analysis is shown above. The horizontal axis is the draft order starting at January 1st on the left and proceeding to December 31st on the right. The vertical axis is the draft order number. The smoothing process shows
a. that there is a consistent tendency for later birth dates to be associated with lower draft order numbers.
b. that there is a positive trend to the data.
c. that there appears to be no nonrandom association between birth date and draft order number.
d. that the draft in 1970 was nonrandom and that men with later birth dates were less likely to be called for service than those with earlier birth dates.
e. None of the above are correct.

25. Which of the following is not a problem with moving-average forecasting?
a. It produces serially correlated forecasts.
b. It removes short-term variability by averaging nearby data.
c. It cannot predict reversals in trends.
d. It cannot model non-stationary data.
e. All the above.
26. Which type of time-series data should moving-average smoothing methods produce the best forecasts?
   a. Seasonal.
   b. Stationary.
   c. Trending.
   d. Cyclical.
   e. All the above.

27. Which method uses an arithmetic mean to forecast the next period?
   a. Naive.
   b. Moving averages.
   c. Exponential smoothing.
   d. Adaptive filtering.
   e. None of the above

Simple Smoothing

Note: The next three questions relate to the following data:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Actual Series</th>
<th>Forecast Series</th>
<th>Forecast Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>110</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>3</td>
<td>115</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

28. If a smoothing constant of .3 is used, what is the exponentially smoothed forecast for period 4?
   a. 106.6.
   b. 103.0.
   c. 115.0.
   d. 112.6.
   e. 104.4.

29. What is the forecast error for period 3?
   a. -3.
   b. -12.
   c. -10.
   d. -7.
   e. +7.

30. If a three-month moving-average model is used, what is the forecast for period 4?
   a. 104.4.
   b. 106.6.
   c. 107.1.
   d. 108.3.
   e. 110.2.
31. In the Adaptive-Response-Rate Single Exponential Smoothing model, the smoothing parameter
   a. is not a constant.
   b. varies from period to period.
   c. is determined by the ratio of the absolute value of the smoothed error divided by
      the absolute smoothed error.
   d. is the ratio of two smoothed error measures.
   e. All of the above.

\[ Y_t = Le^{-ae^{-bt}} \]

32. The simple equation above represents
   a. a Logistics function
   b. a Croston intermittent function
   c. a Probit function
   d. a Gompertz function

\[ Y_t = \frac{L}{1 + ae^{-bt}} \]

33. The simple equation above represents
   a. a Logistics function
   b. a Croston intermittent function
   c. a Probit function
   d. a Gompertz function

34. The "L" independent variable in the growth models we examined represents
   a. the upper limit of the "Y" variable
   b. the number of observations in the original data set
   c. the growth rate of the dependent variable
   d. the lower limit of the dependent variable
Smoothing 2

35. Consider the ForecastX printout above. This is the forecast for a manufactured product.
   a. This is a Winter's Exponential Smoothing model.
   b. This is a Holt's Smoothing model.
   c. This is an event model.
   d. This is a Simple Smoothing model.

36. Consider the ForecastX printout above.
   a. There is a little trend in the data.
   b. There is clear seasonality in the data.
   c. The event indices show little promotional effect.
   d. All of the above are correct.

37. Consider the ForecastX printout above. The seasonal index 4 has a value of 1.14. This indicates
   a. that sales in period 4 are usually below average.
   b. that sales in period 4 are usually above average.
   c. that sales in period 4 are usually quite close to the average.
   d. that sales in period 4 are not seasonal.

38. The Gamma factor above is given as 0.00.
   a. This indicates that there is little seasonality.
   b. This indicates that there is little trend.
   c. This indicates that the events have little effect on sales.
   d. This indicates that the model has little explanatory power.
39. In the ForecastX model presented above
   a. All of the events contribute positively to sales.
   b. Some of the events contribute negatively to sales.
   c. None of the events contribute negatively to sales
   d. None of the events contribute positively to sales.

   Growth

<table>
<thead>
<tr>
<th>Audit Trail - Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy Measures</strong></td>
</tr>
<tr>
<td>AIC</td>
</tr>
<tr>
<td>BIC</td>
</tr>
<tr>
<td>Mean Absolute Percentage Error (MAPE)</td>
</tr>
<tr>
<td>R-Square</td>
</tr>
<tr>
<td>Adjusted R-Square</td>
</tr>
<tr>
<td>Root Mean Square Error</td>
</tr>
</tbody>
</table>

   | **Method Statistics**     | **Value** |
   | Method Selected           | Gompertz Curve |
   | Minimum                   | 0.00       |
   | Maximum                   | 1,200.00   |

40. Consider the growth model Audit Trail statistics shown above. The "Maximum" shown here as 1,200.00
   a. is a value calculated to be the largest value the model may achieve.
   b. is a value set to be the largest value the model may achieve.
   c. is a value representing the maximum growth rate possible over the forecast period.
   d. is a value representing the square of the maximum growth rate possible over the forecast period.

41. In the growth model Audit Trail shown above a Gompertz Curve was probably selected because
   a. it was harder to achieve constant improvement as the maximum value was approached.
   b. it was easier to achieve constant improvement as the maximum value was approached.
   c. a "bell shaped" function was expected.
   d. the trend was nonlinear.

42. In the growth model Audit Trail shown above the saturation point is
   a. 100 percent.
   b. 15.55.
   c. 1,200.
   d. 66.28
smoothing 3

43. In running an exponential smoothing model the following results were obtained:

- The Beta value listed above indicates that the model
  a. is probably unreliable for forecasting.
  b. has a very high level smoothing constant.
  c. exhibits a rather high degree of trend.
  d. exhibits a rather high degree of seasonality.
  e. None of the above are correct.

44. In the same smoothing model listed above (assuming January is the first month in the data set)
- The greatest seasonal variation appears in May.
- The greatest seasonal variation appears in December.
- There appears to be little variation between months.
- There is almost even variation between months.
- None of the above are correct. The data is quarterly.
45. Once again, in the smoothing model just above, the Gamma coefficient reported
   a. indicates a high degree of seasonality.
   b. indicates some trend in the data.
   c. indicates an almost stationary data set.
   d. is statistically insignificant.
   e. None of the above are correct.

46. For the smoothing model shown above, the product that is modeled is probably most like which of the following products in terms of its yearly sales pattern?
   a. New housing sales
   b. Jewelry sales
   c. Mustard sales
   d. Human insulin sales
   e. None of these products would be similar to the sales pattern exhibited by the smoothing model above.

47. Consider the smoothing model results shown in the following graph of actual and predicted sales:

   ![Graph of Actual and Predicted Sales]

   The darker line above is the actual data and the lighter line is the fitted data.

   Which of the following would be a likely set of parameters to see in this exponential smoothing estimate?
   a. Alpha = 0.37, Beta = 0.22, Gamma = 0.01
   b. Alpha = 0.05, Beta = 0.00, Gamma = 0.37
   c. Alpha = 0.37, Gamma = 0.01
   d. Alpha = 0.44
   e. None of the above are plausible.

48. A simple-centered 3-point moving average of the time-series variable Xt is given by:
   a. \((X_{t-1} + X_{t+2} + X_{t+3})/3\).
   b. \((X_t + X_{t-1} + X_{t+2})/3\).
   c. \((X_{t+1} + X_t + X_{t-1})/3\).
   d. None of the above.
___ 49. Which forecasting model assumes that the pattern exhibited by historical data can best be represented by an arithmetic average of nearby observations?
   a. Simple exponential smoothing.
   b. Naive methods.
   c. Moving average smoothing.
   d. Holt's smoothing.
   e. None of the above.

___ 50. The term 'exponential' in the exponential smoothing method refers to
   a. weights on past data that increase exponentially into the past.
   b. weights on past data that decrease exponentially into the past.
   c. calculation uses a weighted average.
   d. using a non-weighted polynomial on past data.
   e. None of the above.

Essay Problems. Answer all three.

Each essay is to be answered on the reverse side of the answer sheet used to answer the multiple choice questions.

Each essay is worth 10% of your total grade on the exam.

51. Compare the use of the following three models:

   Gompertz Curve

   Logistics Curve

   Bass Model

When would it be appropriate to use each model? How do the models differ? What are the parameters of each model? How are the parameters of each model chosen?

52. Explain the use and estimation of an “event model.” When is such a model used? What are the parameters of such a model and how are they chosen? What is the meaning of an “underlying model” when speaking of event models?

53. A new product has been recently introduced by your firm. Explain at least two methods that could be used to forecast the sales of this product. Explain what information you would need to implement each method. Also explain what factors would favor one method over the other.