Crash Course in Forecasting
Multiple Choice Quiz

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Instructions

This quiz contains 10 multiple choice questions. Each question may have **multiple correct answers**. Read each option carefully and refer to the detailed explanations to understand why each option is correct or incorrect.

1 Question 1: Fundamental Forecasting Principles

Which of the following statements about forecasting are correct?

A) Forecasts are always more accurate for shorter time horizons than longer ones

B) Forecasts should include measures of uncertainty

C) More complex models always produce better forecasts

D) Forecast accuracy typically decreases as the forecast horizon increases

Correct Answers: A, B, D

Explanations:

- **A) CORRECT** - Short-term forecasts are generally more accurate because there's less time for conditions to change and less uncertainty to accumulate. Near-term events are more predictable than distant future events.
- **B) CORRECT** - Good forecasting practice requires quantifying uncertainty through confidence intervals, prediction intervals, or probability distributions. Point estimates without uncertainty measures provide incomplete information.
- **C) INCORRECT** - This is a common misconception. Complex models can overfit data and perform poorly on new data. Simpler models often generalize better and are more robust. The principle of parsimony (Occam's Razor) suggests preferring simpler models when they perform comparably.
- **D) CORRECT** - As we look further into the future, more variables can change, more uncertainty accumulates, and our predictions become less reliable. This is a fundamental property of forecasting across most domains.

2 Question 2: Time Series Components

Which components are typically found in time series data?

A) Trend

B) Seasonality

C) Cyclical patterns

D) Random noise

Correct Answers: A, B, C, D

Explanations:

- **A) CORRECT** - Trend represents the long-term increase or decrease in the data over time. It shows the general direction the series is moving (upward, downward, or stable).
- **B) CORRECT** - Seasonality refers to regular patterns that repeat at fixed, known periods (daily, weekly, monthly, quarterly, yearly). For example, retail sales spike during holidays.
- **C) CORRECT** - Cyclical patterns are fluctuations that occur at irregular intervals, typically lasting longer than a year. Economic cycles (boom and bust) are classic examples, unlike seasonal patterns which have fixed periods.
- **D) CORRECT** - Random noise (or irregular component) represents unpredictable variations that cannot be attributed to trend, seasonality, or cycles. It's the residual variation after accounting for systematic patterns.

3 Question 3: Evaluating Forecast Accuracy

Which metrics can be used to evaluate forecast accuracy?

A) Mean Absolute Error (MAE)

B) Root Mean Squared Error (RMSE)

C) Mean Absolute Percentage Error (MAPE)

D) R-squared (R^2)

Correct Answers: A, B, C

Explanations:

- **A) CORRECT** - MAE measures the average absolute difference between forecasts and actual values. It's interpretable in the original units and gives equal weight to all errors. Formula: MAE = $\frac{\sum |actual - forecast|}{n}$
- **B) CORRECT** - RMSE measures the square root of average squared errors, penalizing larger errors more heavily than MAE. It's useful when large errors are particularly undesirable. Formula: RMSE = $\sqrt{\frac{\sum (actual - forecast)^2}{n}}$
- **C) CORRECT** - MAPE expresses errors as percentages, making it scale-independent and useful for comparing forecasts across different series. However, it can be problematic when actual values are near zero. Formula: MAPE = $\frac{\sum |\frac{actual - forecast}{actual}|}{n} \times 100\%$
- **D) INCORRECT** - While R^2 measures how well a model fits historical data, it's not a forecast accuracy metric. It can be high even when forecasts are poor. R^2 measures explained variance in-sample, not out-of-sample prediction accuracy.

4 Question 4: Moving Average Methods

What are characteristics of moving average forecasting methods?

A) They smooth out short-term fluctuations

B) They give equal weight to all observations in the window

C) They can adapt quickly to sudden changes

D) They're suitable for data with strong trends

Correct Answers: A, B

Explanations:

- **A) CORRECT** - Moving averages smooth data by averaging recent observations, which filters out random noise and reveals underlying patterns. This is one of their primary purposes.
- **B) CORRECT** - Simple moving averages assign equal weight to each observation within the window period. For example, a 5-period moving average weights each of the last 5 observations at 20%.
- **C) INCORRECT** - Moving averages actually lag behind sudden changes because they average past data. They respond slowly to structural breaks or shifts. Methods like exponential smoothing with high alpha values adapt more quickly.
- **D) INCORRECT** - Simple moving averages perform poorly with trending data because they always lag behind the trend. They work best for stationary data. For trends, you need methods like double exponential smoothing or trend-adjusted techniques.

5 Question 5: Exponential Smoothing

Which statements about exponential smoothing are true?

A) Recent observations receive more weight than older observations

B) It requires storing all historical data

C) The smoothing parameter (alpha) controls responsiveness to changes

D) Higher alpha values make forecasts more stable

Correct Answers: A, C

Explanations:

- **A) CORRECT** - Exponential smoothing applies exponentially decreasing weights to older observations. The most recent observation gets the highest weight, and weights decay exponentially as you go back in time.
- **B) INCORRECT** - A key advantage of exponential smoothing is that it only requires the previous forecast and the most recent observation. The formula is: New forecast = α(actual) + $(1 - \alpha)$(old forecast). You don't need to store historical data.
- **C) CORRECT** - Alpha (α) ranges from 0 to 1. Higher values (closer to 1) give more weight to recent observations, making the forecast more responsive. Lower values smooth more and respond more slowly to changes.
- **D) INCORRECT** - This is backwards. Higher alpha values make forecasts LESS stable and more responsive to recent changes. Lower alpha values produce more stable, heavily smoothed forecasts that change gradually.

6 Question 6: Seasonality and Seasonal Adjustment

Which approaches can handle seasonality in forecasting?

A) Seasonal decomposition

B) Seasonal dummy variables

C) Seasonal ARIMA models

D) Ignoring it completely

Correct Answers: A, B, C

Explanations:

- **A) CORRECT** - Seasonal decomposition separates data into trend, seasonal, and irregular components. Methods like classical decomposition or STL (Seasonal and Trend decomposition using Loess) can isolate and model seasonal patterns.
- **B) CORRECT** - Adding dummy variables for seasons (months, quarters, days of week) in regression models explicitly captures seasonal effects. For monthly data, you'd use 11 dummy variables (one season is the baseline).
- **C) CORRECT** - SARIMA (Seasonal ARIMA) models include seasonal autoregressive, differencing, and moving average terms to capture repeating patterns. They're powerful for data with both trend and seasonality.
- **D) INCORRECT** - Ignoring seasonality when it exists leads to poor forecasts. The model will miss systematic patterns, resulting in biased predictions that are consistently wrong at certain times of year. You must account for seasonality to get accurate forecasts.

7 Question 7: Judgmental Forecasting

What are advantages of incorporating expert judgment in forecasting?

A) Experts can incorporate information not in historical data

B) It eliminates all forecasting bias

C) It's useful when little or no historical data exists

D) Experts can anticipate structural changes or disruptions

Correct Answers: A, C, D

Explanations:

- **A) CORRECT** - Human experts can consider qualitative factors, market intelligence, upcoming events, and contextual knowledge that isn't captured in quantitative data. This can significantly improve forecasts.
- **B) INCORRECT** - Expert judgment actually introduces various biases (anchoring, optimism bias, groupthink, recency bias). While valuable, it doesn't eliminate bias—it may even introduce more. Structured approaches like Delphi method can help reduce but not eliminate bias.
- **C) CORRECT** - For new products, emerging markets, or unprecedented situations with limited historical data, expert judgment may be the only viable forecasting approach. Statistical models need sufficient data to work effectively.
- **D) CORRECT** - Experts can foresee regulatory changes, technological disruptions, competitor actions, or other structural shifts that historical patterns won't reveal. This forward-looking capability is a key strength of judgmental forecasting.

8 Question 8: Forecast Combination

Why might combining multiple forecasts improve accuracy?

A) Different models capture different patterns in the data

B) Combination reduces the impact of any single model's errors

C) The best single model is always superior to combinations

D) Combination can be more robust across different conditions

Correct Answers: A, B, D

Explanations:

- **A) CORRECT** - Different forecasting methods have different strengths. One might capture trends well, another seasonality, another recent changes. Combining them leverages multiple perspectives on the data.
- **B) CORRECT** - Averaging or weighted combination smooths out individual model errors. If errors are uncorrelated across models, they can partially cancel out, leading to more stable forecasts (diversification principle).
- **C) INCORRECT** - While theoretically the best model should be optimal, in practice we don't know which model is best for future data. Research shows simple averages often outperform individual models. The "forecast combination puzzle" describes how combinations frequently beat individual forecasts.
- **D) CORRECT** - Combined forecasts tend to be more robust because they don't rely on assumptions of any single model. If conditions change and one model fails, others may still perform well, providing insurance against model risk.

9 Question 9: Time Series Stationarity

Which statements about stationarity are correct?

A) A stationary series has constant mean over time

B) Differencing can transform a non-stationary series to stationary

C) All forecasting methods require stationary data

D) Variance should be constant in a stationary series

Correct Answers: A, B, D

Explanations:

- **A) CORRECT** - Stationarity requires statistical properties (mean, variance, autocorrelation) to be constant over time. A constant mean is a key requirement—the series should fluctuate around a stable level.
- **B) CORRECT** - Differencing (computing changes between consecutive observations) is a common technique to remove trends and achieve stationarity. First differencing often removes linear trends; seasonal differencing removes seasonal patterns.
- **C) INCORRECT** - Not all methods require stationarity. Many modern techniques (exponential smoothing, structural models, some machine learning methods) can handle non-stationary data directly. ARIMA models specifically use differencing to handle non-stationarity.
- **D) CORRECT** - Weak stationarity requires constant variance (homoscedasticity) over time. If variance changes (heteroscedasticity), transformations like logarithms or Box-Cox can help stabilize variance.

10 Question 10: Forecast Value and Decision-Making

What determines whether a forecast adds value to decision-making?

A) The forecast must be perfectly accurate

B) The forecast is better than the decision-maker's alternative

C) The forecast reduces uncertainty in a meaningful way

D) The forecast can be acted upon in time

Correct Answers: B, C, D

Explanations:

- **A) INCORRECT** - Perfect accuracy is impossible and unnecessary. A forecast adds value if it's better than alternatives (naïve forecasts, judgment alone, doing nothing) and helps make better decisions, even if imperfect. The goal is useful guidance, not perfection.
- **B) CORRECT** - A forecast's value is relative. If your forecast is more accurate than the baseline (like assuming tomorrow equals today), it adds value. Even a modestly improved forecast can lead to significantly better decisions.
- **C) CORRECT** - Forecasts add value by reducing uncertainty to a level where better decisions become possible. If uncertainty remains too high for decisions to change, the forecast doesn't add value, no matter how sophisticated.
- **D) CORRECT** - Actionability is crucial. A forecast that arrives too late to influence decisions is useless, even if accurate. Timeliness and the ability to adjust plans based on forecasts are essential for value creation.

Answer Key Summary

1. A, B, D
2. A, B, C, D
3. A, B, C
4. A, B
5. A, C
6. A, B, C
7. A, C, D
8. A, B, D
9. A, B, D
10. B, C, D