PCA and Factor Analysis – Quiz

Probability & Statistics

Question 1

What is the main goal of Principal Component Analysis (PCA)?

A. To identify latent constructs underlying observed variables
B. To reduce dimensionality while maximizing variance explained
C. To test hypotheses about factor structure
D. To classify observations into groups

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Answer: B
PCA aims to reduce the number of variables while retaining as much variance as possible. It creates new uncorrelated variables (principal components) ordered by variance explained.

Question 2

In PCA, eigenvalues represent:

A. The correlation between variables
B. The variance explained by each principal component
C. The number of factors to extract
D. The reliability of the measurement

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Answer: B
Each eigenvalue represents the amount of variance captured by its corresponding principal component. Larger eigenvalues indicate more important components.

Question 3

A scree plot is used to:

A. Test the normality assumption
B. Determine the number of components or factors to retain
C. Display factor loadings
D. Compare different rotation methods

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A scree plot shows eigenvalues in descending order. The "elbow" point where the curve flattens suggests how many components to retain.

Question 4

What is the Kaiser criterion for retaining factors?

A. Retain factors with eigenvalues greater than 1
B. Retain factors that explain at least 5% variance
C. Retain exactly 3 factors
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Answer: A
The Kaiser criterion (eigenvalue ¿ 1 rule) suggests keeping factors with eigenvalues greater than 1, as they explain more variance than a single original variable.

Question 5

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B. Make factors more interpretable
C. Reduce the number of factors
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Answer: B
Rotation redistributes variance among factors to create simpler structure with clearer loadings. It does not change total variance explained but makes interpretation easier.

Question 6

Communality (h^2) in factor analysis represents:

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B. The proportion of variance in a variable explained by the factors
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Answer: B
Communality is the proportion of a variable's variance explained by the common factors. Low communality suggests the variable doesn't fit well with the factor solution.

Question 7

What is the key difference between PCA and Factor Analysis?

A. PCA uses correlation matrices; FA uses covariance matrices
B. PCA analyzes total variance; FA focuses on shared (common) variance
C. PCA is for continuous data; FA is for categorical data
D. PCA requires larger sample sizes

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D. PCA requires larger sample sizes

Answer: B

PCA analyzes all variance (common + unique). Factor analysis models only the common variance shared among variables, treating unique variance as error.

Question 8

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Answer: B
Varimax is an orthogonal rotation that keeps factors uncorrelated while maximizing variance of squared loadings within each factor for simpler interpretation.

Question 9

A factor loading of 0.75 indicates:

A. Weak relationship between variable and factor
B. Strong relationship between variable and factor
C. The variable should be removed
D. The factor is unreliable

Question 9

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A. Weak relationship between variable and factor
B. Strong relationship between variable and factor
C. The variable should be removed
D. The factor is unreliable

Answer: B
A loading of 0.75 indicates a strong relationship. Generally, loadings above 0.40 are considered meaningful, and above 0.70 are considered strong.

Question 10

When should you use PCA over Exploratory Factor Analysis?

A. When developing psychological scales
B. When you have a theory about latent constructs
C. When you want data reduction without assuming underlying factors
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Answer: C
Use PCA for pure data reduction without theoretical assumptions about latent structures. Use EFA when you believe underlying factors cause the correlations among variables.