A

24131 **120 MINUTES**

1. Let N denote the set of natural numbers and define the set $A_n = \{(n+1)k : k \epsilon N\}$. Then $A_1 \cap A_2 =$

   A) $\emptyset$ B) A_2 C) A_5 D) A_1

2. $\frac{1}{1\times2} + \frac{1}{2\times3} + \cdots + \frac{1}{n\times(n+1)} =$

   A) 1 B) $\frac{n}{(n-1)}$ C) $\frac{n}{(n+1)}$ D) $\frac{1}{(n+1)}$

3. Which of the following is a Cauchy sequence?

   A) $\{\sqrt{n}\}$ B) $\left\{n + \frac{(-1)^n}{n}\right\}$ C) $\{\ln(n)\}$ D) $\left\{1 + \frac{1}{2!} + \cdots + \frac{1}{n!}\right\}$

4. $\lim_{x\to0} x \cos\left(\frac{1}{x}\right) =$

   A) 0 B) 1 C) -1 D) Does not exist

5. If f and g are uniformly continuous on R, then which of the following statement(s) is/ are true?
   1. Their product fg is uniformly continuous on R
   2. Composite function fog is uniformly continuous on R

   A) 1 only B) 2 only C) Both 1 and 2 D) Neither 1 nor 2

6. Which of the following statement(s) is / are true?
   1. Every continuous function is Riemann integrable
   2. Every Riemann integrable function on [a, b] is monotonic on [a, b].

   A) 1 only B) 2 only C) Both 1 and 2 D) Neither 1 nor 2

7. If A is a non-singular matrix then $|A^{-1}| =$

   A) $|A|$ B) $\frac{1}{|A|}$ C) 1 D) None of these

8. Let A be an n × n real matrix such that $A^2 + I = 0$, then

   A) n is any integer B) n must be odd
   C) n must be even D) None of these

9. Let A be a real 3×5 matrix having rank 3, then nullity of A =

   A) 3 B) 5 C) 8 D) 2

10. Let $Q = X'AX$ be a real quadratic form in n variables with rank r and index s. Then Q is negative definite if:
A) r = n, s = n B) r = n, s = 0 C) r < n, s = r D) r < n, s = 0

11. Let A be any n×n real nilpotent matrix. Then its eigen values are:
A) 0 B) 1 C) ± 1 D) None of these

12. Consider the vector space S of R^3 defined by
$S = \left\{ x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} : 2x_1 - x_2 + 4x_3 = 0, x_1, x_2, x_3 \epsilon R \right\}$. Then the dimension of S is:

A) 3 B) 2 C) 1 D) 0

13. In a meeting 11 persons are seated on 11 chairs at a round table. Probability that two specified persons are sitting next to each other is:

A) $\frac{1}{5}$ B) $\frac{1}{10}$ C) $\frac{2}{10!}$ D) $\frac{9}{11}$

14. In a selection procedure a student has to pass two tests. The probability that a student passes test I is 0.6 and the probability that he passes both test is 0.4. The probability that he passes at least one test is 0.8. What is the probability that he passes test II?
A) 0.24 B) 0.2 C) 0.6 D) None of these

15. If the odds are 2:3 for event A, 3:7 for event B, and 1:4 for A∩B, then the odds for the event A or B is:
A) 71:84 B) 1:1 C) 1:5 D) 1:2

16. Consider the random experiment of rolling a pair of fair dice. Let A be the event that 1 on one die, B be the event that 1 on the other die and C be the event that sum of the dice is odd. Then which of the following is **not** true?
A) A and B are independent B) B and C are independent
C) A and C are independent D) A, B, C are independent

17. An urn contains five fair coins, three 2- headed coins, and four 2-tailed coins. A coin is randomly selected and flipped. If the flip resulted in head, then the probability that the selected coin was fair is:

A) $\frac{5}{12}$ B) $\frac{3}{17}$ C) $\frac{5}{11}$ D) $\frac{1}{8}$

18. The cumulative distribution function of a random variable X is

$$F(x) = \begin{cases} 0, x < 1 \\ \frac{1}{3}, 1 \le x < 4 \\ \frac{1}{2}, 4 \le x < 6 \\ \frac{6}{5}, 6 \le x < 10 \\ 1, x \ge 10 \end{cases}$$

Find $P(3 \le X \le 6)$?

A) $\frac{1}{2}$ B) 0 C) $\frac{5}{6}$ D) $\frac{3}{4}$

19. A random variable X has pdf $f(x) = cx, 0 \le x \le 1$. Then $P\left(\frac{1}{4} < X \le \frac{1}{2}\right) =$

A) $\frac{5}{16}$ B) $\frac{3}{16}$ C) $\frac{1}{4}$ D) 0

20. The joint pdf of (X, Y) is $f(x,y) = \frac{1}{y}, 0 < x < y < 1$. Then the conditional pdf of X given Y is:

A) $\frac{1}{y}, 0 < x < 1$ B) $1, 0 < x < 1$

C) $\frac{x}{y}, 0 < x < y$ D) $\frac{1}{y}, 0 < x < y$

21. The joint pmf of (X,Y)is as follows

$$f(x,y) = \begin{cases} \frac{1}{4}, (x,y) = (1,3),(3,7) \\ \frac{1}{2}, \quad (x,y) = (2,5) \end{cases}$$

Then the correlation between X and Y is:

A) 0 B) 1 C) -1 D) None of these

22. If X has pdf $f(x) = 2x, 0 < x < 1$. Then the pdf of Y = X^2 is:

A) $g(y) = 2y, 0 < y < 1$ B) $g(y) = 2\sqrt{y}, 0 < y < 1$
C) $g(y) = 1, 0 < y < 1$ D) $g(y) = 2(1-y), 0 < y < 1$

23. Let X be a random variable with mean 12 and variance 16. Then a lower bound for P (4 < X < 20) is:

A) $\frac{3}{4}$ B) $\frac{1}{4}$ C) $\frac{1}{3}$ D) $\frac{4}{9}$

24. Which of the following is a characteristic function?

A) $\frac{1}{1+t^4}$ B) $\log(1+t)$ C) e^{-t^4} D) $1-|t|, |t| \le 1$

25. If X and Y are any two random variables such that $E(X^2) < \infty$, then which of the following is true?

A) $V(X) \leq V[E(X|Y)]$ B) $V(X) \geq V[E(X|Y)]$

C) $V(X) \leq V[E(Y|X)]$ D) None of these

26. Let $\{Y_n\}$ be a sequence of random variables with pmf $P\left(Y_n = \pm\frac{1}{n}\right) = \frac{1}{2}$. Then which of the following is true?

A) Y_n converges in rth mean to 0 but Y_n does not converge almost surely to 0

B) Y_n converges almost surely to 0 but Y_n does not converge in rth mean to 0

C) Y_n converges in rth mean to 0 and Y_n converges almost surely to 0

D) Y_n converges in rth mean to 0 and Y_n converges almost surely to 1

27. For the sequence of random variables $\{X_n\}$, with $P(X_n = \pm n^\alpha) = \frac{1}{2}, \alpha > 0$, weak law of large numbers holds for:

A) $\alpha < \frac{1}{2}$ B) $\alpha > \frac{1}{2}$ C) $\alpha > 2$ D) All $\alpha > 0$

28. Let X and Y be random variables such that $E(|X|^3)$ and $E(|Y|^3)$ exists, then

A) $E(|X+Y|^3) \leq 4[E(|X|^3) + E(|Y|^3)]$

B) $E(|X+Y|^3) \leq [E(|X|^3) + E(|Y|^3)]$

C) $E(|X+Y|^3) \geq 4[E(|X|^3) + E(|Y|^3)]$

D) $E(|X+Y|^3) \leq 3[E(|X|^3) + E(|Y|^3)]$

29. If the pgf of a random variable is $(2-s)^{-1}$, then $E(X^2) =$

A) 1 B) 2 C) 3 D) $\frac{1}{2}$

30. The third cumulant of a random variable $X \sim b\left(n, \frac{1}{2}\right)$ is:

A) $\frac{n}{4}$ B) $\frac{n}{8}$ C) $\frac{n}{2}$ D) 0

31. Let X and Y be independent random variables such that $X \sim b(3, 0.2)$ and $Y \sim b(4, 0.2)$. Then $P(X = 2|X + Y = 5)$=

A) 0.2 B) 0.4 C) $\frac{3}{7}$ D) $\frac{4}{7}$

32. Let $X_1, X_2, \ldots, X_k$ are independent Poisson random variables with parameters $\lambda_1, \lambda_2, \ldots, \lambda_k$ respectively. Then the conditional distribution of $(X_1, X_2, \ldots, X_k)$ given $X_1 + X_2 + \cdots + X_k$ is:

A) Binomial B) Multinomial C) Poisson D) None of these

33. If X and Y are iid exponential random variables with mean $\frac{1}{\theta}$, then the pdf of $Z = \frac{X}{Y}$ is:

A) $f(z) = \theta e^{-\theta z}, z > 0$ B) $f(z) = \theta^2 z e^{-\theta z}, z > 0$

C) $f(z) = \frac{1}{(1+z)^2}, z > 0$ D) $f(z) = 1, 0 < z < 1$

34. For the random variable with pdf $f(x) = \frac{\alpha\beta^{\alpha}}{x^{\alpha+1}}, \alpha > 0, x \geq \beta > 0$, harmonic mean is:

A) $\beta(1+\frac{1}{\propto})$ B) $\frac{\alpha}{\beta(\alpha+1)}$ C) $\frac{\alpha\beta}{(\alpha-1)}$ D) β

35. For the random variable with pdf $f(x) = \frac{1}{x\sqrt{2\pi}}\, exp\left\{-\frac{1}{2}(logx)^2\right\}, x > 0$, mode is:

A) e B) $\frac{1}{e}$ C) $\sqrt{e}$ D) $\sqrt{e-1}$

36. If X and Y are iid $N(0,\sigma^2)$ random variables, then the distribution of $\frac{Y}{X}$ is:

A) $N(0,\sigma^2)$ B) $N(0,1)$ C) $C(\sigma^2, 0)$ D) $C\ (1,0)$

37. Let $X_{1:2}, X_{2:2}$ be the order statistics of a random sample of size 2 taken from U(0, 1). Then the mean of $Y = \frac{X_{1:2}}{X_{2:2}}$ is:

A) $\frac{2}{3}$ B) $\frac{1}{2}$ C) 1 D) Does not exist

38. Let $X_{1:2}, X_{2:2}$ be the order statistics of a random sample of size 2 taken from standard exponential distribution. Then the pdf of $(X_{2:2}\ |X_{1:2})$ is:

A) $e^{x-y}, x < y < \infty$
B) $e^{-x-y}, x < y < \infty$
C) $e^{-y}(1-e^{-x})^{-1}, x < y < \infty$
D) $e^{-x}(1-e^{-y})^{-1}, x < y < \infty$

39. Let $\bar{X}$ be the mean and S^2 be the variance of a random sample of size n taken from $N(\mu,\sigma^2)$. Then which of the following statements is /are true?

1. $\bar{X}$ and S^2 are independent
2. $\frac{\sqrt{n}(\bar{X}-\mu)}{S}$ has Student's t distribution with n degrees of freedom
3. $\frac{n\,S^2}{\sigma^2}$ has χ^2 distribution with n – 1 degrees of freedom

A) 1, 2 & 3 B) 1 & 2 only C) 1 & 3 only D) 2 & 3 only

40. Let $X_1 \sim N(5,2), X_2 \sim N(3,2), X_3 \sim N(4,2)$ and are independent. Then the distribution of $\frac{{X_1}^2+{X_2}^2+{X_3}^2}{2}$ is:

A) χ^2 distribution with 3 degrees of freedom
B) $N(12,6)$
C) Non central χ^2 distribution with non centrality parameter 6 and 3 degrees of freedom
D) Non central χ^2 distribution with non centrality parameter 25 and 3 degrees of freedom

41. Let (X, Y) be a bivariate normal random variable with E(X) = E(Y) = 0, V(X) = 2, V(Y) = 1 and $\rho = 0.6$. Then $V(Y|X = 1) =$

A) 0.4 B) 0.72 C) 0.64 D) 1.28

42. A random sample of size 18 from a bivariate normal population gives a correlation coefficient of 0.6. For testing the significance of correlation, the value of the test statistic is:

A) 3 B) $\frac{3\sqrt{17}}{4}$ C) 6 D) $\frac{16}{3}$

43. The number of possible samples of size 5 out of 20 population size in SRSWR is equal to:

A) $20C_5$ B) 20^5 C) 5^{20} D) 100

44. If a larger units have more probability of their inclusion in the sample, the sampling is known as:

A) SRSWOR B) Stratified sampling
C) PPS sampling D) Cluster sampling

45. The gain in precision of stratified sampling with Neyman allocation over simple random sampling arises from:

A) Differences between population strata means
B) Differences between population strata standard deviations
C) Both A and B
D) None of these

46. From a finite population of size N= 100, a systematic sample of size 10 is taken, where k is a positive integer. Let ρ denote the intra class correlation coefficient between pairs of units within a systematic sample. Then systematic sampling is more efficient than SRSWOR if:

A) $\rho > \frac{1}{9}$ B) $\rho < -\frac{1}{99}$ C) $\rho > -\frac{1}{99}$ D) $0 < \rho < 1$

47. Ratio estimator is less precise than SRSWOR if coefficient of variation of auxiliary variate is:

A) more than that of the variate under study
B) less than that of the variate under study
C) less than twice the coefficient of variation of the variate under study
D) more than twice the coefficient of variation of the variate under study

48. Which of the following method(s) is/are used to draw sample under PPSWR

A) Cumulative total method B) Lahiri's method
C) Both A and B D) None of these

49. Let X_1, X_2, X_3 be three variables with correlation between X_1 and X_2 is equal to 0.4, correlation between X_1 and X_3 is equal to 0.6 and correlation between X_3 and X_2 is equal to 0.8. The partial correlation between X_1 and X_2 after eliminating the effect of X_3 is:

A) $-\frac{1}{6}$ B) $\frac{1}{6}$ C) $\frac{1}{2}$ D) None of these

50. If $X = \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} \sim N_3(0,\ \Sigma)$, where $\Sigma = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 2 \end{bmatrix}$, then the distribution of $X_1{}^2 + \frac{1}{4}X_2{}^2 + \frac{1}{2}X_3{}^2$ is:

A) Chi square with 2 degrees of freedom
B) Chi square with 3 degrees of freedom
C) Wishart distribution with 3 degrees of freedom
D) F distribution with (3, 2) degrees of freedom

51. Let $X = \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} \sim N_3(\mu,\ \Sigma)$,where $\mu = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$, $\Sigma = \begin{bmatrix} 1 & \alpha & \alpha^2 \\ \alpha & 1 & 0 \\ \alpha^2 & 0 & 1 \end{bmatrix}$. Let $Y_1 = \begin{bmatrix} X_1 \\ X_2 \end{bmatrix}$ and $Y_2 = X_3$. Then covariance matrix of $(Y_1|Y_2)$ is:

A) $\begin{bmatrix} 1 & \alpha & \alpha^2 \\ \alpha & 1 & 0 \\ \alpha^2 & 0 & 1 \end{bmatrix}$ B) $\begin{bmatrix} 1 & \alpha \\ \alpha & 1 \end{bmatrix}$

C) $\begin{bmatrix} 1-\alpha^4 & \alpha \\ \alpha & 1 \end{bmatrix}$ D) None of these

52. Let $\{X(t), t\epsilon T\}$ be a stochastic process such that the random variables $X(t_2) - X(t_1), X(t_3) - X(t_2), \ldots, X(t_n) - X(t_{n-1})$ are independent for all choices of $t_1 < t_2 < \cdots < t_n$, then the process is called:

A) Process with independent increments
B) Weakly stationary
C) Strongly stationary
D) All the above

53. Let $\{X(t), t \geq 0\}$be a Poisson process with intensity parameter 2.5. Suppose each occurrence of an event is registered with probability 0.2, independent of other occurrences. Let $\{Y(t), t \geq 0\}$be the process of registered occurrences. Then Y(t) is a Poisson process with parameter:

A) 2.5 B) 2.7 C) 2 D) 0.5

54. Semi - averages method is used for measurement of trend when:

A) Trend is linear
B) Observed data contains yearly values
C) The given time series contains odd number of value
D) None of these

55. Find x in the following table if Laspeyre's and Paasche's Price Index Numbers are equal.

Commodity	Base year		Current year	
	Price	Quantity	Price	Quantity
I	5	2	10	3
II	4	5	x	5

A) 11 B) 8
C) 4 D) Cannot be determined

56. Let $X_1, X_2, \ldots, X_n$ be a random sample from Poisson distribution with mean θ, $\theta \in (0, \infty)$. If $\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$, then the unbiased estimator of $\frac{1}{\theta}$ is :

A) $\frac{1}{\overline{X}}$ B) $\frac{\overline{X}}{1+\overline{X}}$ C) $\frac{\overline{X}}{\overline{X}-1}$ D) Does not exist

57. Let $X_1, X_2, \ldots, X_n$ be a random sample from $U[\theta, \theta + 1]$, $\theta \in (-\infty, \infty)$. If $X_{(n)} = \max(X_1, X_2, \ldots, X_n)$ and $X_{(1)} = \min(X_1, X_2, \ldots, X_n)$, then which among the following statement(s) is/are true?

1. $\left(X_{(1)}, X_{(n)}\right)$ is minimal sufficient but not complete sufficient statistic for θ.
2. $\left(X_{(1)}, X_{(n)}\right)$ is complete sufficient statistic for θ.
3. $\left(X_{(n)} - X_{(1)}, \frac{X_{(n)}+X_{(1)}}{2}\right)$ is minimal sufficient statistic for θ
4. $X_{(n)} - X_{(1)}$ is complete sufficient statistic for θ.

A) 1 only B) 2 & 4 only C) 1 & 3 only D) 2, 3 & 4 only

58. Let $X_1, X_2, \ldots, X_n$ be a random sample from $N(\mu, 1)$ and $\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$. If it is known that μ must be nonnegative, then the MLE of μ is:

A) $\hat{\mu} = \overline{X}$ B) $\hat{\mu} = 0$

C) $\hat{\mu} = \begin{cases} \overline{X} & \text{if } \overline{X} \;\; 0 \\ 0 & \text{if } \overline{X} < 0 \end{cases}$ D) $\hat{\mu} = \begin{cases} \overline{X} & \text{if } \overline{X} \;\; 0 \\ 0 & \text{if } \overline{X} > 0 \end{cases}$

59. Let $X_1, X_2, \ldots, X_n$ be random sample from $N(\mu, \sigma^2)$. Consider the estimates $s^2 = \frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2$ and $S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(X_i - \overline{X})^2$ for estimating σ^2. Then which of the following is true?

A) $MSE(S^2) < MSE(s^2)$
B) $MSE(S^2) > MSE(s^2)$
C) $MSE(S^2) = MSE(s^2)$
D) There does not exist a specified relation between $MSE(S^2)$ and $MSE(s^2)$

60. The UMVUE of α based on a random sample of size n with sample mean $\overline{X}$ taken from the PDF $f(x,\alpha) = \alpha e^{-\alpha x}, x > 0, \alpha > 0$ is:

A) $T = \overline{X}$ B) $T = \frac{1}{\overline{X}}$ C) $T = \frac{n-1}{n\overline{X}}$ D) $T = \frac{n}{(n-1)\overline{X}}$

61. Let $\overline{X}$ be the sample mean of a random sample from a normal population with mean and variance equal to θ, $\theta > 0$. Then the MLE of θ is:

A) $\hat{\theta} = (\overline{X})^2$ B) $\hat{\theta} = -\frac{1}{2} + \frac{1}{2}\sqrt{1 + 4\overline{X}^2}$

C) $\hat{\theta} = -\frac{\overline{X}}{2} + \sqrt{\overline{X}^2 + \left(\frac{\overline{X}}{2}\right)^2}$ D) $\hat{\theta} = -\frac{\overline{X}}{2} - \sqrt{\overline{X}^2 + \left(\frac{\overline{X}}{2}\right)^2}$

62. If X_i, $i = 1,2,\dots,n$ be iid normal random variables with known mean μ and unknown variance σ^2. Then the Jeffreys prior for σ^2 is given by:

A) $\pi(\theta) \propto \frac{1}{\sigma}$ B) $\pi(\theta) \propto \frac{1}{\sigma^2}$ C) $\pi(\theta) \propto \frac{1}{\sigma^4}$ D) $\pi(\theta) \propto 1$

63. Which among the following statement(s) is/are true?

1. Bayes estimator of a parameter with respect to quadratic loss function is the median of the posterior distribution.
2. Bayes estimator of a parameter is a function of the sufficient estimator.

A) 1 only B) 2 only C) Both 1 & 2 D) Neither 1 nor 2

64. Let $X_1, X_2, \dots, X_n$ be a random sample from a population with PDF

$$f(x \mid \theta) = \begin{cases} e^{-(x-\theta)}, & x \geq \theta \\ 0, & x < \theta \end{cases}$$

Then the likelihood ratio test for testing $H_0: \theta \leq \theta_0$ against $H_1: \theta > \theta_0$ is:

A) $\lambda(\boldsymbol{x}) = \begin{cases} 1, & \overline{x} \leq \theta_0 \\ e^{-n(\overline{x}-\theta_0)}, & \overline{x} > \theta_0 \end{cases}$

B) $\lambda(\boldsymbol{x}) = \begin{cases} 1, & \overline{x} > \theta_0 \\ e^{-n(\overline{x}-\theta_0)}, & \overline{x} \leq \theta_0 \end{cases}$

C) $\lambda(\boldsymbol{x}) = \begin{cases} 1, & x_{(1)} \leq \theta_0 \\ e^{-n(x_{(1)}-\theta_0)}, & x_{(1)} > \theta_0 \end{cases}$, where $x_{(1)} = min(x_1, x_2, \dots, x_n)$

D) $\lambda(\boldsymbol{x}) = \begin{cases} 1, & x_{(1)} > \theta_0 \\ e^{-n(x_{(1)}-\theta_0)}, & x_{(1)} \leq \theta_0 \end{cases}$, where $x_{(1)} = min(x_1, x_2, \dots, x_n)$

65. Let (X_1, X_2) be a random sample of size 2 from the PDF

$f(x) = \begin{cases} \theta x^{\theta-1}, & 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$. If we choose the critical region

$C = \{(X_1, X_2): X_1 + X_2 \leq 1\}$ for testing $H_0: \theta = 1$ against $H_1: \theta = 2$, then the power of the test is:

A) $\frac{1}{6}$ B) $\frac{1}{2}$ C) $\frac{2}{3}$ D) $\frac{8}{9}$

66. Which of the following statements about the p −value is true?

A) The p −value is the probability that the null hypothesis is true.
B) The p −value is the probability that the alternative hypothesis is true.
C) The p − value is the probability of obtaining the observed or more extreme results if the alternative hypothesis is true.
D) The p −value is the probability of obtaining the observed results or results which are more extreme if the null hypothesis is true.

67. A study was set up to look at whether there was a difference in the mean arterial blood pressure between two groups of volunteers, after 6 weeks of following one of two treatment programs. One group of volunteers were given an exercise regimen to follow for the 6 weeks and the other group were given the same exercise regimen with the addition of an experimental tablet. Which type of t- test should be used in this situation?

A) One sample t test B) Independent samples t test
C) Paired sample t test D) None of the t test would be suitable

68. Which among the following statement(s) is/are true when considering the Mann-Whitney U test?

1. It is the nonparametric equivalent of the paired t test
2. It uses the ordering of data values.
3. It is used when the distribution of data is skewed.
4. It assumes that standard deviations of the two independent groups are equal.

A) 1 & 2 only B) 2 & 3 only
C) 1, 2 & 3 only D) 2, 3 & 4 only

69. The expected number of runs in a random arrangement of 10 values of the variable X and 15 values of the variable Y is:

A) 7 B) 12 C) 13 D) 15

70. If A and B $(0 < B < 1 < A)$ are the stopping constants of an SPRT with strength (α, β). Then the approximate value of A and B are:

A) $A \approx \frac{\beta}{1-\alpha}, B \approx \frac{1-\beta}{\alpha}$ B) $A \approx \frac{1-\beta}{\alpha}, B \approx \frac{\beta}{1-\alpha}$

C) $A \approx \frac{\alpha}{1-\beta}, B \approx \frac{1-\alpha}{\beta}$ D) $A \approx \frac{1-\alpha}{\beta}, B \approx \frac{\alpha}{1-\beta}$

71. If the mean value for the weight of 25 men was calculated to be 90 kg with a standard deviation of 10 kg, what would be the 95% confidence interval for the mean weight approximately?
A) 84 to 96 B) 86 to 94 C) 80 to 100 D) 70 to 110

72. A 95% confidence interval estimate for the difference between two population means, $\mu_1 - \mu_2$ is determined to be (60.75, 66.52). If the confidence level is reduced to 90%, the confidence interval:
A) Becomes wider B) Remain the same
C) Becomes narrower D) More information is needed

73. Consider the linear model $\boldsymbol{y}_{n\times 1} = \boldsymbol{A}_{n\times p}\beta_{p\times 1} + \boldsymbol{e}_{n\times 1}$. Let $\boldsymbol{l}'\boldsymbol{y}$ be an estimate of the estimable linear function $\lambda'\beta$and $\boldsymbol{l}_s$ be the projection of $\boldsymbol{l}$ on the estimation space of the model. Then:
A) $\boldsymbol{l}_s'\boldsymbol{y}$ is an estimate of $\lambda'\beta$with $Var(\boldsymbol{l}_s'\boldsymbol{y}) \leq Var(\boldsymbol{l}'\boldsymbol{y})$
B) $\boldsymbol{l}_s'\boldsymbol{y}$ is an estimate of $\lambda'\beta$with $Var(\boldsymbol{l}_s'\boldsymbol{y}) \geq Var(\boldsymbol{l}'\boldsymbol{y})$
C) $\boldsymbol{l}_s'\boldsymbol{y}$ is an estimate of $\lambda'\beta$with $Var(\boldsymbol{l}_s'\boldsymbol{y}) = Var(\boldsymbol{l}'\boldsymbol{y})$
D) $\boldsymbol{l}_s'\boldsymbol{y}$ is not an estimate of $\lambda'\beta$

74. In two-way ANOVA with 10 rows and 8 columns, the error degrees of freedom is:
A) 9 B) 80 C) 72 D) 63

75. Let $N = (n_{ij})$ is the incidence matrix (n_{ij}) is the number of times the i^{th} treatment occurs in the j^{th} block of a BIBD with v number of treatments and b number of blocks. Then:
A) $Rank(NN') = v$ B) $Rank(NN') = v - 1$
C) $Rank(NN') = b$ D) $Rank(NN') = b - 1$

76. For a 2^2 factorial design, with usual notations, the third entry in the column (2) of the table obtained by Yates' procedure is:
A) $(1) + (a) + (b) + (ab)$ B) $-(1) + (a) - (b) + (ab)$
C) $-(1) - (a) + (b) + (ab)$ D) $(1) - (a) - (b) + (ab)$

77. Consider a clinical trial in which the effect of two skin creams A and B on human body is examined. To conduct the experiment, n persons are chosen randomly and then Cream A is applied to one of the randomly chosen arms of each person, cream B to the other. What kind of a design is this?
A) Completely Randomized Design
B) Randomized Block Design
C) Latin Square Design
D) Balanced Incomplete Block Design

78. Consider a 2^5 design with factors A, B, C, D and E, run in four blocks by confounding the effects ADE and BCE. Then the treatment combinations in the principal block are:
A) (1), abc, ad, ace, bc, cde, abcd, bde
B) (1), be, d, abde, abc, ce, bcd, acde
C) (1), abce, abd, ae, c, bcde, act, de
D) (1), ade, bce, ab, bd, ac, cd, abcde

79. To determine whether the test statistic of one-way ANOVA is statistically significant, it can be compared to a critical value. What are the information needed to determine the critical value?
A) sample size, number of groups
B) mean, sample standard deviation
C) expected frequency, obtained frequency
D) mean square treatments, mean square error

80. What assumption does analysis of covariance have that analysis of variance does not?
A) Homogeneity of variance
B) Homoscedasticity
C) Homogeneity of sample size
D) Homogeneity of regression slopes