JNUEE PHD Computer Sciences Microsystems

1) Which of the following approach can be used to create an artificial environment to generate the data and information?[Question ID = 27748][Question Description = Ph.D.SCSH_Q_001]

1. Inferential Approach [Option ID = 185287]
2. Empirical Approach [Option ID = 185288]
3. Simulation Approach [Option ID = 185289]
4. Experimental Approach [Option ID = 185290]

2) Consider the following about the scientific method.

S1: Subjective consideration

S2: Probabilistic predictions

S3: Empirical evidence

Which of the following is true?

[Question ID = 27749][Question Description = Ph.D.SCSH_Q_002]

1. S1 true and S2, S3 false

   [Option ID = 185291]
2. S1, S2 and S3 true

   [Option ID = 185292]
3. S1, S2 and S3 false

   [Option ID = 185293]
4. S1 false and S2, S3 true

   [Option ID = 185294]

3) A researcher wants to collect the information from the gasoline customers, for example, he can choose a set as a number of stations and conducts the interviews. This type of sampling is called [Question ID = 27750][Question Description = Ph.D.SCSH_Q_003]

1. Simple random sampling [Option ID = 185295]
2. Systematic sampling [Option ID = 185296]
3. Convenience sampling [Option ID = 185297]
4. Stratified sampling [Option ID = 185298]

4) If a researcher has no hypothesis to start with, she explains her findings on the basis of some theory. That theory is known as[Question ID = 27751][Question Description = Ph.D.SCSH_Q_004]

1. Generalisation [Option ID = 185299]
2. Conceptualization [Option ID = 185300]
3. Aggregation [Option ID = 185301]
4. Interpretation [Option ID = 185302]

5) Consider the following:

i. Pilot survey	**a. Preliminary survey**
ii. Experience survey	**b. Formulative research**
iii. Observation method	**c. Behavioural science**
iv. Exploratory	**d. Discussion with colleagues**

Which is the correct matching?

[Question ID = 32850][Question Description = Ph.D.SCSH_Q_005]

1. i-a , ii-b, iii-c, iv-d

   [Option ID = 185303]
2. i-b , ii-c, iii-a, iv-d

   [Option ID = 185304]
3. i-a , ii-c, iii-d, iv-b

   [Option ID = 185305]
4. i-a , ii-d, iii-c, iv-b

   [Option ID = 185306]

6) When the dependent variable is not free from the influence of the extraneous variable, the relationship between the dependent and independent variables is said to be[Question ID = 32851][Question Description = Ph.D.SCSH_Q_006]

1. Correlated relationship [Option ID = 185307]
2. Confounded relationship [Option ID = 185308]
3. Interdependent relationship [Option ID = 185309]
4. Controlled relationship [Option ID = 185310]

7) Consider the following statements about the exploratory design.

S1: It is rigid design

S2: It is structured or well thought out instruments for collection of data

S3: It is non-probability sampling design

S4: It has no pre-planned design for analysis

Which of the following is true?

[Question ID = 32852][Question Description = Ph.D.SCSH_Q_007]

1. Only S3, S4 true and S1, S2 false

   [Option ID = 185311]
2. Only S3, S4 false and S1, S2 true

   [Option ID = 185312]
3. Only S1, S3 false and S2, S4 true

   [Option ID = 185313]
4. S1, S2, S3 and S4 true

   [Option ID = 185314]

8) Elimination of the variability due to the extraneous factor from the experimental error is based on[Question ID = 32853][Question Description = Ph.D.SCSH_Q_008]

1. Principle of Randomization [Option ID = 185315]
2. Principle of Replication [Option ID = 185316]
3. Principle of Local Control [Option ID = 185317]
4. Principle of Optimization [Option ID = 185318]

9) In a small city, taking a random selection of 64 out of 2400 intersections, the mean number of car accidents per year is 3.2 and the sample standard deviation is 0.8. The standard error of mean is

[Question ID = 32854][Question Description = Ph.D.SCSH_Q_009]

1. 0.097

   [Option ID = 185319]
2. 0.032

   [Option ID = 185320]
3. 0.015

   [Option ID = 185321]

4. 0.057

[Option ID = 185322]

10) The experimental design frequently used in agricultural research is called[Question ID = 32855][Question Description = Ph.D.SCSH_Q_010]

1. Randomized block design [Option ID = 185323]
2. Before-and-after with control design [Option ID = 185324]
3. Completely randomized design [Option ID = 185325]
4. Latin-square design [Option ID = 185326]

11) If P_i represents the proportion of population included in stratum i and n represents the total sample size, then the number of elements selected from stratum i is

[Question ID = 32856][Question Description = Ph.D.SCSH_Q_011]

1. n^*P_i

[Option ID = 185327]

2. $i * n$

[Option ID = 185328]

3. $i^*n^*P_i$

[Option ID = 185329]

4. i^*P_i

[Option ID = 185330]

12) For finding the working efficiency of a nationalised bank in India, considering the samples of few banks, which of the following sampling is preferred?[Question ID = 32857][Question Description = Ph.D.SCSH_Q_012]

1. Convenience sampling [Option ID = 185331]
2. Purposive sampling [Option ID = 185332]
3. Multi-stage sampling [Option ID = 185333]
4. Systematic sampling [Option ID = 185334]

13) The rank of the students in their M.Tech. class is computed by[Question ID = 32858][Question Description = Ph.D.SCSH_Q_013]

1. Interval scale [Option ID = 185335]
2. Nominal scale [Option ID = 185336]
3. Ordinal scale [Option ID = 185337]
4. Ratio scale [Option ID = 185338]

14) Consider the following statements about the test of validity.

S1: If the instrument contains a representative sample of the universe, the construct validity is good.

S2: The content validity is the degree to which scores on a test can be accounted for by the explanatory constructs of a sound theory.

S3: Criterion-related validity reflects the success of measures used for some empirical estimating purpose.

Which of the following is correct?

[Question ID = 32859][Question Description = Ph.D.SCSH_Q_014]

1. S1, S2 and S3 are true

[Option ID = 185339]

2. S1, S2 true and S3 false

[Option ID = 185340]

3. S1, S3 true and S2 false

[Option ID = 185341]

4. S1, S2 false and S3 true

[Option ID = 185342]

15) Consider the following:

i. cumulative scale	**a. Differential scales**
ii. Factor scales	**b. Multidimensional scaling**
iii. Consensus approach:	**c. Guttman's scalogram**
iv. Item analysis approach	**d. Summated scales**

Which is correct matching?

[Question ID = 32860][Question Description = Ph.D.SCSH_Q_015]

1. i-c, ii-b, iii-a, iv-d

[Option ID = 185343]

2. i-c, ii-d, iii-a, iv-b

[Option ID = 185344]

3. i-c, ii-a, iii-d, iv-b

[Option ID = 185345]

4. i-a, ii-d, iii-c, iv-b

[Option ID = 185346]

16) Which of the following is concerned with broad underlying feelings or motivations or with the course of individual's life experience?[Question ID = 32861][Question Description = Ph.D.SCSH_Q_016]

1. Focussed interview [Option ID = 185347]
2. Non-directive interview [Option ID = 185348]
3. Structured interviews [Option ID = 185349]
4. Clinical interview [Option ID = 185350]

17) The questionnaire that provides no scope of respondent opinion is called[Question ID = 32862][Question Description = Ph.D.SCSH_Q_017]

1. Open Ended [Option ID = 185351]
2. Structured [Option ID = 185352]
3. Unstructured [Option ID = 185353]
4. Close ended [Option ID = 185354]

18) Data collection method consisting of a set of questions that are filled by enumerator is called[Question ID = 32863][Question Description = Ph.D.SCSH_Q_018]

1. Schedule [Option ID = 185355]
2. Questionnaire [Option ID = 185356]
3. Survey [Option ID = 185357]
4. Audits [Option ID = 185358]

19) Which of the following is not related to survey?[Question ID = 32864][Question Description = Ph.D.SCSH_Q_019]

1. Social and behavioural sciences [Option ID = 185359]
2. Field research [Option ID = 185360]
3. Correlation analysis relatively more important [Option ID = 185361]
4. Manipulation of the variable [Option ID = 185362]

20) Consider the following:

i. Causal analysis	**a.Prediction of an entity's possibility of belonging to a particular group**
ii. Canonical analysis	**b. Functional relationships existing between two or more variables.**
iii. Inferential analysis	**c. Estimate the population values**
iv. Multiple discriminant analysis	**d. Predict a set of dependent variables from their joint covariance**

Which is correct matching?

[Question ID = 32865][Question Description = Ph.D.SCSH_Q_020]

1. i-c, ii-b, iii-a, iv-d

   [Option ID = 185363]
2. i-b, ii-d, iii-c, iv-a

   [Option ID = 185364]
3. i-c, ii-a, iii-d, iv-b

   [Option ID = 185365]
4. i-a, ii-d, iii-c, iv-b

   [Option ID = 185366]

21) Let X =Mean, M=Median, and Z=Mode. The condition for positive skewness is

[Question ID = 32866][Question Description = Ph.D.SCSH_Q_021]

1. X < M < Z

   [Option ID = 185367]
2. M < Z < X

   [Option ID = 185368]
3. X < Z < M

   [Option ID = 185369]
4. X > M > Z

   [Option ID = 185370]

22) The size of sample is n and sample proportion of success and failure are p and q, respectively. If the standard variate for the given confidence level is z, then the confidence interval for the population proportion is [Question ID = 32867][Question Description = Ph.D.SCSH_Q_022]

1. $p \pm z.\sqrt{\frac{p.q}{n}}$

   [Option ID = 185371]
2. $p \pm z.\sqrt{\frac{n}{p.q}}$

   [Option ID = 185372]
3. $p \pm z.\sqrt{\frac{2n}{p.q}}$

   [Option ID = 185373]
4. $p \pm z.\sqrt{\frac{p.q}{2n}}$

   [Option ID = 185374]

23) Consider the following statements:

S1: Cross tabulation is specially useful when the data are in nominal form.

S2: Asymmetrical relationship is said to exist if one variable is responsible for another variable.

S3: Symmetrical relationship exists when the two variables mutually influence or reinforce each other.

Which of the following is correct?

[Question ID = 32868][Question Description = Ph.D.SCSH_Q_023]

1. S1, S2 and S3 are true

   [Option ID = 185375]
2. S1, S2 true and S3 false

   [Option ID = 185376]
3. S1, S3 true and S2 false

   [Option ID = 185377]
4. S1, S2 false and S3 true

   [Option ID = 185378]

24) Consider the following problems about a high degree of correlation between the independent variables.

S1:Problem of symmetry

S2:Problem of single collinearity

S3:Problem of multi-collinearity

Which of the following is true?

[Question ID = 27752][Question Description = Ph.D.SCSH_Q_024]

1. S1, S2 and S3 are true

   [Option ID = 185379]
2. S1, S2 true and S3 false

   [Option ID = 185380]
3. S1, S3 true and S2 false

   [Option ID = 185381]
4. S1, S2 false and S3 true

   [Option ID = 185382]

25) The association between two attributes that does not correspond to any real relationship is called[Question ID = 27753][Question Description = Ph.D.SCSH_Q_025]

1. Partial association [Option ID = 185383]
2. Illusory association [Option ID = 185384]
3. Total association [Option ID = 185385]
4. All of these [Option ID = 185386]

26) Consider the following statements about the central limit theorem.

S1: If the sample size increases, then the sampling distribution must approach to an exponential distribution

S2: If the sample size decreases, then the sample distribution must approach to a normal distribution

S3: If the sample size increases, the sampling distribution must approach to a normal distribution

Which of the following is correct?

[Question ID = 27754][Question Description = Ph.D.SCSH_Q_026]

1. S1, S2 and S3 are true

   [Option ID = 185387]
2. S1, S2 true and S3 false

[Option ID = 185388]
3. S1, S3 true and S2 false

[Option ID = 185389]
4. S1, S2 false and S3 true

[Option ID = 185390]

27) The degree of freedom in A-test for n number of pairs is [Question ID = 27755][Question Description = Ph.D.SCSH_Q_027]
1. *n(n+1)* [Option ID = 185391]
2. *n+1* [Option ID = 185392]
3. *n-1* [Option ID = 185393]
4. *n(n-1)* [Option ID = 185394]

28) Consider the following statements about the standard error.

S1: Size of standard error is directly proportional to the sample size

S2: Size of standard error is inversely proportional to the sample size

S3: Parameters of the population are expected to lie with a specified degree of confidence.

Which of the following is correct?

[Question ID = 27756][Question Description = Ph.D.SCSH_Q_028]
1. S1, S2 and S3 are true

[Option ID = 185395]
2. S1, S3 true and S2 false

[Option ID = 185396]
3. S1 false and S2, S3 true

[Option ID = 185397]
4. S1, S2 false and S3 true

[Option ID = 185398]

29) Let σ_p = standard deviation of the sample, σ_s = standard deviation of the population, and n = number of items in the sample. If the population standard deviation is unknown for a large sample, then the standard error of the sample mean ($\bar{x}$) is

[Question ID = 27757][Question Description = Ph.D.SCSH_Q_029]
1. $\sigma_{\bar{x}} = \frac{\sigma_p}{\sqrt{n}}$

[Option ID = 185399]
2. $\sigma_{\bar{x}} = \frac{\sigma_s}{\sqrt{n}}$

[Option ID = 185400]
3. $\sigma_{\bar{x}} = \frac{\sigma_s}{\sqrt{2n}}$

[Option ID = 185401]
4. $\sigma_{\bar{x}} = \frac{\sigma_p}{\sqrt{2n}}$

[Option ID = 185402]

30) An estimator should approach to the value of population parameter as the sample size becomes larger and larger. This property is called[Question ID = 27758][Question Description = Ph.D.SCSH_Q_030]
1. Property of Efficiency [Option ID = 185403]
2. Property of Sufficiency [Option ID = 185404]
3. Property of Consistency [Option ID = 185405]
4. Property of Unbiasedness [Option ID = 185406]

31) Consider 3 coins out of which 2 are fair and one is biased, landing heads with probability 2/3, but it is not known which coin is biased. The coins are permuted randomly and tossed each of the coins. The first and second coins come up with heads and third coin comes up with tail. The probability that the first coin is biased is

[Question ID = 27759][Question Description = Ph.D.SCSH_Q_031]
1. 1/3

[Option ID = 185407]
2. 2/3

[Option ID = 185408]
3. 1/5

[Option ID = 185409]
4. 2/5

[Option ID = 185410]

32) Two players play a tournament in which as soon as any player wins 7 matches, the game is stopped. The players are evenly matched, so each player wins any game with probability of ½, independently of other games. The probability of winning 5 games by the loser player when the tournament is over is

[Question ID = 27760][Question Description = Ph.D.SCSH_Q_032]
1. 12/2048

[Option ID = 185411]
2. 35/4096

[Option ID = 185412]
3. 99/512

[Option ID = 185413]
4. 231/1024

[Option ID = 185414]

33) A monkey types on 10-letter keyword that has a-j small English letters only. Each letter is chosen independently and uniformly at random from these letters. If the monkey types 10,000 letters, the expected number of times the sequence "edaaj" appears is

[Question ID = 27761][Question Description = Ph.D.SCSH_Q_033]
1. 9995/100000

[Option ID = 185415]
2. 9996/100000

[Option ID = 185416]
3. 9996/200000

[Option ID = 185417]
4. 9995/200000

[Option ID = 185418]

34) A certain test for a particular virus is 95% accurate. A person submits to the test and the results are positive. Suppose that the person comes from a population of 1,00,000, where 2000

people suffer from the disease caused by that virus. The probability that the person under test has that disease is approximately

[Question ID = 27762][Question Description = Ph.D.SCSH_Q_034]

1. 0.28

[Option ID = 185419]

2. 0.70

[Option ID = 185420]

3. 0.21

[Option ID = 185421]

4. 0.41

[Option ID = 185422]

35) Consider two shipments (labelled as I and II) of mobile processors from two manufacturers A and B, as shown in table.

	Manufacturer	
	A	B
Shipment	I. 600 good, 500 defective	400 good, 300 defective
	II. 300 good, 600 defective	500 good, 900 defective

then,

[Question ID = 27763][Question Description = Ph.D.SCSH_Q_035]

1. Manufacturer A is providing better processors than manufacturer B.

[Option ID = 185423]

2. Manufacturer B is providing better processors than manufacturer A.

[Option ID = 185424]

3. From this data, it cannot be decided.

[Option ID = 185425]

4. Both manufacturers are equally providing better processors.

[Option ID = 185426]

36) Let X be a uniform random variable on [a, b]. Then, for $c \le d$, $P(X \le c \mid X \le d)$ is[Question ID = 27764][Question Description = Ph.D.SCSH_Q_036]

1. p> $\frac{c-a}{d-a}$

[Option ID = 185427]

2. p> $\frac{b-c}{b-a}$

[Option ID = 185428]

3. p> $\frac{c-a}{d-b}$

[Option ID = 185429]

4. p> $\frac{c-a}{b-a}$

[Option ID = 185430]

37) Let $X_1, X_2, \ldots, X_n$ be exponentially distributed random variables with parameters $\theta_1, \theta_2, \ldots, \theta n$, respectively. Let $X = \min(X_1, X_2, \ldots, Xn)$. Which of the following is true?

[Question ID = 27765][Question Description = Ph.D.SCSH_Q_037]

1. X is exponentially distributed with parameter $\min(\theta_1, \theta_2, \ldots, \theta n)$.

[Option ID = 185431]

2. X is exponentially distributed with parameter $\Sigma_{i=1 \text{ to } n}\ \theta_i$

[Option ID = 185432]

3. X is exponentially distributed with parameter $(\Sigma_{i=1 \text{ to } n}\ \theta_i) / n$

[Option ID = 185433]

4. X is exponentially distributed with parameter $\max(\theta_1, \theta_2, \ldots, \theta n)$.

[Option ID = 185434]

38) Let X1 be the time of the first event of the Poisson process (assuming λ as the parameter of Poisson process), X2 be the interval of time between the first and second event, …, and Xn be the interval of time between the (n-1)th and nth event. Which of the following is true?

[Question ID = 27766][Question Description = Ph.D.SCSH_Q_038]

1. All X_i i=1, 2,…,n, have same distribution.

[Option ID = 185435]

2. Only X_1 has Poisson distribution.

[Option ID = 185436]

3. All X_i i=1, 2,…,n, have Poisson distribution but with different parameters.

[Option ID = 185437]

4. Only X_n has Poisson distribution.

[Option ID = 185438]

39) Let $X_1, X_2, \ldots, Xn$ be uniform random variables on [0, 1]. Let $Y_1, Y_2, \ldots, Yn$ be the same values as $X_1, X_2, \ldots, Xn$ in increasing sorted order. Then $E\{Y_k\}$ is

[Question ID = 27767][Question Description = Ph.D.SCSH_Q_039]

1. k/(n+1)

[Option ID = 185439]

2. (k+1)/n

[Option ID = 185440]

3. k/n

[Option ID = 185441]

4. k/(k+n)

[Option ID = 185442]

40) Let a and b be positive constants, and the joint distribution of two random variables X and Y be $F(x, y) = 1 - e^{-ax} - e^{-by} + e^{-(ax+by)}$, over the range $x, y \ge 0$. Then, $P(X \le 3 \mid Y=4)$ is

[Question ID = 27768][Question Description = Ph.D.SCSH_Q_040]

1. $1 - e^{-3a}$

[Option ID = 185443]

2. $1 - e^{-(3a+4b)}$

[Option ID = 185444]

3. $1 - e^{-4b}$

[Option ID = 185445]

4. $1 - e^{-3a} - e^{-4b} + e^{-(3a+4b)}$

[Option ID = 185446]

41) Given that n ≥ 1 arrivals have occurred in the time interval (0, t], the conditional joint probability density function of the arrival times $T_1, T_2,\ldots,Tn$, i..e., $f(t_1, t_2,\ldots,tn \mid N(t) = n)$, $0 \le t1 \le t2 \le \ldots \le tn \le t$, N(t) denotes the number of events in the interval (0, t], is

[Question ID = 27769][Question Description = Ph.D.SCSH_Q_041]

1. $\frac{1}{nt}$

[Option ID = 185447]

2. $\frac{1}{t^n}$

[Option ID = 185448]

3. $\frac{n!}{t^n}$

[Option ID = 185449]

4. $\frac{n}{t^n}$

[Option ID = 185450]

42) Let X_1 and X_2 be two normal random variables with zero mean and unit variance. The random variable $(X_1)^2 + (X_2)^2$ is

[Question ID = 32064][Question Description = Ph.D.SCSH_Q_042]

1. normal random variable with zero mean and unit variance.

[Option ID = 185451]

2. normal random variable with zero mean and √2 variance

[Option ID = 185452]

3. normal random variable with zero mean and 2 variance.

[Option ID = 185453]

4. is not normal random variable.

[Option ID = 185454]

43)

Let

$$f_{XY}(x,y) = \begin{cases} k, & 0 < x < y < 1 \\ 0, & otherwise \end{cases}$$

Then, $f_{y|x}(y|x)$ is given by

[Question ID = 32065][Question Description = Ph.D.SCSH_Q_043]

1. $\frac{1}{y}$

[Option ID = 185455]

2. $\frac{1}{y-1}$

[Option ID = 185456]

3. $\frac{1}{x}$

[Option ID = 185457]

4. $\frac{1}{1-x}$

[Option ID = 185458]

44)

Let X be a uniform random variable in the interval (-π/2, π/2) and Y = sin(X). Then, the probability density function of Y, $f_Y(y)$, is

[Question ID = 32066][Question Description = Ph.D.SCSH_Q_044]

1. $\frac{1}{\sqrt{(1-y^2)}}$

[Option ID = 185459]

2. $\frac{2\pi}{\sqrt{(1-y^2)}}$

[Option ID = 185460]

3. $\frac{1}{\pi\sqrt{(1-y^2)}}$

[Option ID = 185461]

4. $\frac{1}{\sqrt{2\pi(1-y^2)}}$

[Option ID = 185462]

45) A box contains white and black balls. When two balls are drawn without replacement, the probability that both balls are white is 2/5. Then, the minimum number of balls in the box is[Question ID = 32067][Question Description = Ph.D.SCSH_Q_045]

1. 12 [Option ID = 185463]
2. 10 [Option ID = 185464]
3. 8 [Option ID = 185465]
4. 6 [Option ID = 185466]

46)

The probability that the point (x, y) is in the region R of the 2-D plane can be interpreted as the (probability) mass in this region. Let

$$\frac{1}{} e^{-\left(\frac{x^2+y^2}{}\right)}$$

$f(x,y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\pi\sigma^2}}$

The mass in the circle $x^2 + y^2 \le a^2$ is

[Question ID = 32068][Question Description = Ph.D.SCSH_Q_046]

1. $e^{-(a^2/2\pi\sigma^2)}$

[Option ID = 185467]

2. $e^{-(a^2/2\sigma^2)}$

[Option ID = 185468]

3. $e^{-(a^2/\sigma^2)}$

[Option ID = 185469]

4. $e^{-(a^2/4\sigma^2)}$

[Option ID = 185470]

47) Let X and Y be two independent exponential random variables with common parameter λ, and U = X + Y, V = X - Y. The joint probability distribution of U and V (with appropriate ranges for u and v) is[Question ID = 32069][Question Description = Ph.D.SCSH_Q_047]

1. $f(u,v) = \frac{1}{2\lambda^2} e^{-(u/\lambda)}$

[Option ID = 185471]

2. $f(u,v) = \frac{1}{2\lambda^2} e^{-(uv/\lambda^2)}$

[Option ID = 185472]

3. $f(u,v) = \frac{1}{\lambda} e^{-(u/\lambda)}$

[Option ID = 185473]

4. $f(u,v) = \frac{1}{\lambda} e^{-(uv/\lambda)}$

[Option ID = 185474]

48) Consider the following two statements:

S1 : For two random variables X and Y with E{X} = η_x and E{Y}= η_y, (X - η_x) and (Y - η_y) are orthogonal.

S2: If the random variables X and Y are uncorrelated and η_x = 0 or η_y = 0 , then X and Y are orthogonal.

[Question ID = 32070][Question Description = Ph.D.SCSH_Q_048]

1. Only statement S1 is true.

[Option ID = 185475]

2. Only statement S2 is true.

[Option ID = 185476]

3. Both statements S1 and S2 are true.

[Option ID = 185477]

4. Neither statement S1 nor S2 is true.

[Option ID = 185478]

49) Let the random variables X and Y be jointly normal with zero mean. Then [Question ID = 32071][Question Description = Ph.D.SCSH_Q_049]

1. $E\{X^2Y^2\} = E\{X^2\}E\{Y^2\}$

[Option ID = 185479]

2. $E\{X^2Y^2\} = (E\{X\})^2(E\{Y\})^2$

[Option ID = 185480]

3. $E\{X^2Y^2\} = E\{X^2\} + E\{Y^2\} + 2E^2\{XY\}$

[Option ID = 185481]

4. $E\{X^2Y^2\} = E\{X^2\}E\{Y^2\} + 2E^2\{XY\}$

[Option ID = 185482]

50) Suppose we have 4 distinct balls and 6 distinct boxes. We place at random each ball in one of the boxes. The probability that in 4 pre-selected boxes, one and only one ball is found is[Question ID = 32072][Question Description = Ph.D.SCSH_Q_050]

1. 1/54 [Option ID = 185483]
2. 1/126 [Option ID = 185484]
3. 1/15 [Option ID = 185485]
4. 2/3 [Option ID = 185486]

51) If f is continuous on an interval *(a, b),* and c is any point in the interval, then

[Question ID = 32073][Question Description = Ph.D.SCSH_Q_051]

1. $\int f(x)dx = \frac{d}{dx}[\int_c^x f(t)dt]$

[Option ID = 185487]

2. $\int f(x)dx = \frac{d}{dx}[\int_a^x f(t)dt]$

[Option ID = 185488]

3. $\int f(x)dx = \frac{d}{dx}[\int_x^b f(t)dt]$

[Option ID = 185489]

4. $\int f(x)dx = \int_c^x f(t)dt$

[Option ID = 185490]

52) Let f be a function that is defined on the finite closed interval [a, b]. Which of the following is false?

[Question ID = 32074][Question Description = Ph.D.SCSH_Q_052]

1. If f is not bounded on [a, b], then f is not integrable on [a, b].

[Option ID = 185491]

2. If f is not continuous on [a, b], then f is not integrable on [a, b].

[Option ID = 185492]

3. If f has finitely many discontinuities in [a, b] but is bounded on [a, b], then f is integrable on [a, b].

[Option ID = 185493]

4. If f is continuous in [a, b] and is bounded on [a, b], then f is integrable on [a, b].

[Option ID = 185494]

53)

Suppose $f(x), f'(x)$ and $f''(x)$ are continuous on open interval that contains the point c. If $f'(c) = 0$ and $f''(c) = 0$ then at the point c the function f may hav

[Question ID = 32075][Question Description = Ph.D.SCSH_Q_053]

1. a local maximum only [Option ID = 185495]
2. a local minimum only [Option ID = 185496]
3. a local maxima, a local minima or neither [Option ID = 185497]
4. a point of infection only. [Option ID = 185498]

54) An interior point of the domain of a function f is a critical point of f where f' is

[Question ID = 32076][Question Description = Ph.D.SCSH_Q_054]

1. Either zero or undefined [Option ID = 185499]
2. Undefined only [Option ID = 185500]
3. Zero only [Option ID = 185501]
4. finite [Option ID = 185502]

55) The speed of convergences of the Secant method with multiple roots and Newton Raphson method with multiple roots are[Question ID = 32077][Question Description = Ph.D.SCSH_Q_055]

1. Equal and the value is 1 [Option ID = 185503]
2. Equal and the value is 1.618 [Option ID = 185504]
3. Equal and the value is 2 [Option ID = 185505]
4. Not equal [Option ID = 185506]

56) The Runge - Kutta method with Final Global Error of order $O(h^n)$ is derievd from an appropriate

[Question ID = 34633][Question Description = N_Ph.D.SCSH_Q_056]

1. Euler's Method

[Option ID = 204500]

2. Heun's Method

[Option ID = 204501]

3. Taylor's Method

[Option ID = 204502]

4. Modified Euler's Method

[Option ID = 204503]

57) Consider p vectors each having n components of each. The vectors are linearly dependent if

[Question ID = 32079][Question Description = Ph.D.SCSH_Q_057]

1. $n > p$

[Option ID = 185511]

2. $n \leq p$

[Option ID = 185512]

3. $n \geq p$

[Option ID = 185513]

4. $n < p$

[Option ID = 185514]

58) If F satisfies (i) $F(v + x) = F(v) + F(x)$ and (ii) $F(cx) = cF(x)$ for all vectors v and x in X and all scalars c, then F is called a

[Question ID = 32080][Question Description = Ph.D.SCSH_Q_058]

1. Linear Span [Option ID = 185515]
2. Linear Transformation [Option ID = 185516]
3. Linear Representation [Option ID = 185517]
4. Vector valued function [Option ID = 185518]

59) A subgroup N of a group G is a normal subgroup of Gif for every a in N and every g in G

[Question ID = 32081][Question Description = Ph.D.SCSH_Q_059]

1. gag^{-1} is in N

[Option ID = 185519]

2. aga^{-1} is in N

[Option ID = 185520]

3. gag^{-1} is in G

[Option ID = 185521]

4. aga^{-1} is in G

[Option ID = 185522]

60) The only ring R having no maximal ideals is the

[Question ID = 32082][Question Description = Ph.D.SCSH_Q_060]

1. Unit ring [Option ID = 185523]
2. Zero ring [Option ID = 185524]
3. Field [Option ID = 185525]
4. Set of real numbers [Option ID = 185526]

61) The number of flip flops required to construct a ring counter capable of counting from decimal one to decimal eight will be[Question ID = 32083][Question Description = Ph.D.SCSH_Q_061]

1. 1 [Option ID = 185527]
2. 2 [Option ID = 185528]
3. 4 [Option ID = 185529]
4. 8 [Option ID = 185530]

62) Match List I with List II

List I	List II
Operation	Result
A. X-Y (X > Y) using 1's complement	I. No carry bit generated
B. X-Y (X < Y) using 1's complement	II. Discard carry bit to get the final sum
C. X-Y (X > Y) using 2's complement	III. No carry bit but the result is negative
D. X-Y (X < Y) using 2's complement	IV. Carry bit added to get the final sum.

Choose the correct answer from the options given below:

[Question ID = 27770][Question Description = Ph.D.SCSH_Q_062]

1. A - I, B - II , C - III , D - IV [Option ID = 185531]
2. A - IV , B - I, C - II, D - III [Option ID = 185532]
3. A -III , B - IV , C - II, D - I [Option ID = 185533]
4. A - II, B - I, C - III, D - IV [Option ID = 185534]

63) Consider a J-K flip flop with J=K=1, operating with a 20KHz clock. The output generated will be:[Question ID = 27771][Question Description = Ph.D.SCSH_Q_063]

1. A square wave of 20KHz [Option ID = 185535]
2. A square wave of 10 KHz [Option ID = 185536]
3. A square wave of 5 KHz [Option ID = 185537]
4. Constant high [Option ID = 185538]

64) The boolean expression xy + x'z + yz is equivalent to[Question ID = 27772][Question Description = Ph.D.SCSH_Q_064]

1. x'z+yz [Option ID = 185539]
2. xz+y' [Option ID = 185540]
3. xy+yz [Option ID = 185541]
4. xy+x'z [Option ID = 185542]

65) How many number of RAM chips each of size 1024*8 bits and 2*4 decoders will be needed to construct a 16K*32 bits RAM using the available RAM chip?[Question ID = 27773][Question Description = Ph.D.SCSH_Q_065]

1. 16, 4 [Option ID = 185543]
2. 32, 5 [Option ID = 185544]
3. 64, 5 [Option ID = 185545]
4. 64, 6 [Option ID = 185546]

66) If the operating system running with all the device drivers included in the system, is known as

[Question ID = 27774][Question Description = Ph.D.SCSH_Q_066]

1. Monolithic kernel

   [Option ID = 185547]
2. Micro kernel

   [Option ID = 185548]
3. Shell

   [Option ID = 185549]
4. Batch operating system

   [Option ID = 185550]

67) For a typical operating system environment, if a process is swapped out to the disk, the state of the process becomes[Question ID = 27775][Question Description = Ph.D.SCSH_Q_067]

1. Waiting [Option ID = 185551]
2. Blocked [Option ID = 185552]
3. Suspended [Option ID = 185553]
4. None of the above [Option ID = 185554]

68) Match List I with List II

List I (Book/Theory proposed/Characteristic, etc.)	List II (Author/Thinker/Name of Theory, etc.)
A. Demand Paging	I. Virtual Memory
B. Segmentation	II. No Preemption
C. Thrashing	III. Low Utilization
D. Deadlocks	IV. External Fragmentation

Choose the correct answer from the options given below:

[Question ID = 27776][Question Description = Ph.D.SCSH_Q_068]

1. A - IV, B - I, C - III , D - II [Option ID = 185555]
2. A - I, B -II , C -IV , D - III [Option ID = 185556]
3. A - I, B - IV, C - III , D - II [Option ID = 185557]
4. A - III, B - I, C - II, D - IV [Option ID = 185558]

69) The scheduling policy which is non preemptive by nature is[Question ID = 27777][Question Description = Ph.D.SCSH_Q_069]

1. Shortest Job First (SJF) [Option ID = 185559]
2. Shortest Remaining Time First (SRTF) [Option ID = 185560]
3. Round Robin (RR) [Option ID = 185561]
4. First Come First Serve (FCFS) [Option ID = 185562]

70) Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R

Assertion A : Threads of a process share the latter's instructions and its context.

Reason R : Threads allow the sequential single processor systems to make blocking system calls.

In light of the above statements, choose the *correct* answer from the options given below

[Question ID = 27778][Question Description = Ph.D.SCSH_Q_070]

1. Both **A** and **R** are true and **R** is the correct explanation of **A**

   [Option ID = 185563]
2. Both **A** and **R** are true but **R** is NOT the correct explanation of **A**

   [Option ID = 185564]
3. **A** is true but **R** is false

   [Option ID = 185565]
4. **A** is false but **R** is true

   [Option ID = 185566]

71)

Consider the following running time of given algorithms

i. Bellman-Ford algorithm a. $O(VE)$

ii. Edmonds-Karp algorithm	b. $O(VE^2)$
iii. Johnson's algorithm for sparse graphs	c. $O(V^2 \lg V + VE)$
iv. Hopcroft-Karp bipartite matching algorithm	d. $O(\sqrt{V}\, E)$

Which one is the correct matching?

[Question ID = 27779][Question Description = Ph.D.SCSH_Q_071]
1. i-a, ii-b, iii-c, iv-d [Option ID = 185567]
2. i-a, ii-c, iii-b, iv-d [Option ID = 185568]
3. i-b, ii-c, iii-d, iv-a [Option ID = 185569]
4. i-b, ii-d, iii-c, iv-a [Option ID = 185570]

72) Open-address hash table with load factor $\alpha < 1$, the expected number of probes in a successful search is

[Question ID = 27780][Question Description = Ph.D.SCSH_Q_072]
1. at most 1/α ln 1/(1-α) [Option ID = 185571]
2. at most 1/α ln 1/(1+α) [Option ID = 185572]
3. at least 1/α ln 1/(1+α) [Option ID = 185573]
4. at least 1/α ln 1/(1-α) [Option ID = 185574]

73) Solution of following recurrence relation is

$$T(n) = 2T(\sqrt{n}) + \lg n$$

[Question ID = 27781][Question Description = Ph.D.SCSH_Q_073]
1. O (n lg n)

   [Option ID = 185575]
2. O (lg n lg√ lg √n)

   [Option ID = 185576]
3. O (lg n)

   [Option ID = 185577]
4. O (2^n lg√ n)

   [Option ID = 185578]

74) Suppose that we have numbers between 1 and 1000 in a binary search tree, and we want to search for the number 363. Which of the following sequences could not be the sequence of nodes examined?[Question ID = 27782][Question Description = Ph.D.SCSH_Q_074]
1. 2, 252, 401, 398, 330, 344, 397, 363 [Option ID = 185579]
2. 924, 220, 911, 244, 898, 258, 362, 363 [Option ID = 185580]
3. 925, 202, 911, 240, 912, 245, 363 [Option ID = 185581]
4. 2, 399, 387, 219, 266, 382, 381, 278, 363 [Option ID = 185582]

75) Consider the following relational schema:

EMPLOYEE (Fname, Lname, SSN, Salary, Dno)

DEPARTMENT (Dname, Dnumber)

What is the output for the following SQL query ?

SELECT Dno, COUNT (*) FROM EMPLOYEE WHERE Salary>40000 AND Dno IN (SELECT Dno FROM EMPLOYEE GROUP BY Dno HAVING COUNT (*) > 5) GROUP BY Dno;

Which one of the following is correct?

[Question ID = 27783][Question Description = Ph.D.SCSH_Q_075]
1. Retrieve the department number (Dno) and the number of employees who have salary more than $40,000 having more than five employees in each department.

   [Option ID = 185583]
2. Retrieve the department number (Dno) and the number of employees who have salary more than $40,000 who are working in more than five departments.

   [Option ID = 185584]
3. Retrieve the department number (Dno) and the number of employees who have salary more than $40,000 having less than five employees in each department.

   [Option ID = 185585]
4. Retrieve the department number (Dno) and the number of employees who have salary more than $40,000 having less than five employees in each department.

   [Option ID = 185586]

76) Consider the following C program segment where NODE represents a node in a binary tree:

```
struct NODE{
struct NODE *leftChild;
int element; struct NODE *rightChild;
};
int getValue (struct NODE *ptr){
int value = 0;
if (ptr != NULL) {
if ((ptr→leftChild == NULL) && (ptr→rightChild == NULL))
value = 1;
else
value = value + getValue (ptr→leftChild) + getValue (ptr→rightChild);
}
return (value);
}
```

Which of the value is returned by getValue when a pointer to the root of a binary tree is passed as its argument?

[Question ID = 27784][Question Description = Ph.D.SCSH_Q_076]
1. The number of nodes in the tree

   [Option ID = 185587]
2. The number of leaf nodes in the tree

   [Option ID = 185588]
3. The number of internal nodes in the tree

   [Option ID = 185589]
4. The height of the tree

   [Option ID = 185590]

77) Consider the code fragment of C program.

```
int f (int n){
static int r = 0;
if ( n <= 0) return1;
if(n > 3 ){
 r = n;
return f (n - 2) + 2;
}
return f (n-1) + r;
}
```

Which of the following is correct value of *f(5)*?

[Question ID = 27785][Question Description = Ph.D.SCSH_Q_077]

1. 5

   [Option ID = 185591]
2. 9

   [Option ID = 185592]
3. 7

   [Option ID = 185593]
4. 18

   [Option ID = 185594]

78) Consider the code fragment of C program.

```
int main(){
struct tree{
int h;
int w;
};
struct tree tree1={10};
printf("%d", tree1.w);
printf("%d", tree1.h);
return 0;
}
```

Which of the following is correct output?

[Question ID = 27786][Question Description = Ph.D.SCSH_Q_078]

1. 0 0

   [Option ID = 185595]
2. 0 10

   [Option ID = 185596]
3. 10 0

   [Option ID = 185597]
4. 10 10

   [Option ID = 185598]

79) Consider the code fragment of C program.

```
int a, *b = &a, **c = &b;
a = 4;
 **c = 5;
```

Which of the following is correct about the program?

[Question ID = 27787][Question Description = Ph.D.SCSH_Q_079]

1. does not change the value of a

   [Option ID = 185599]
2. assigns the value of b to a

   [Option ID = 185600]
3. assigns address of c to a

   [Option ID = 185601]
4. assigns 5 to a

   [Option ID = 185602]

80) Consider the code fragment of C program.

```
for (i = 1; i < 5; ++i)
if (i == 3) continue;
else printf (“%d”, i);
```

which of the following is correct output?

[Question ID = 32293][Question Description = Ph.D.SCSH_Q_080]

1. 1 2 3 4

   [Option ID = 185603]
2. 2 4 5

   [Option ID = 185604]
3. 1 2 4

   [Option ID = 185605]
4. 1 2 3

   [Option ID = 185606]

81) Consider the code fragment of C program.

```
 int x, y = 2, z, a;
x = (y *= 2) + (z = a = y);
printf (“%d”, x);
```

Which of the following is correct about the program?

[Question ID = 32294][Question Description = Ph.D.SCSH_Q_081]

1. prints 8

[Option ID = 185607]
2. prints 2

[Option ID = 185608]
3. prints 6

[Option ID = 185609]
4. is syntactically wrong

[Option ID = 185610]

82) Consider the following statements:

S1: Composite attributes cannot be divided into smaller subparts.

S2: Complex attribute is formed by nesting composite attributes and multi-valued attributes in arbitrary way.

S3: A derived attribute is an attribute whose values are computed from other attributes.

Which one of the following is correct?

[Question ID = 32295][Question Description = Ph.D.SCSH_Q_082]
1. S1, S2, S3 are true

[Option ID = 185611]
2. S1 true and S2, S3 false

[Option ID = 185612]
3. S1, S2 true and S3 false

[Option ID = 185613]
4. S1 false and S2, S3 true

[Option ID = 185614]

83) Consider the following universal relation:

U (Emp_ssn, Pno, Esal, Ephone, Dno, Pname, Plocation)

Emp_ssn, Esal, and Ephone refer to the Social Security number, salary, and phone number of the employee.

Pno, Pname, and Plocation refer to the number, name, and location of the project. Dno is the department number.

'The following dependencies are present in relation U.

FD1: Emp_ssn → { Esal, Ephone, Dno }

FD2: Pno → { Pname, Plocation }

FD3: Emp_ssn, Pno → { Esal, Ephone, Dno, Pname, Plocation }

Which one of the following is correct?

[Question ID = 32296][Question Description = Ph.D.SCSH_Q_083]
1. Only Dependency preserving

[Option ID = 185615]
2. Only Non additive join

[Option ID = 185616]
3. Both dependency preserving and Non additive join

[Option ID = 185617]
4. Neither dependency preserving nor non additive join

[Option ID = 185618]

84) Which normal form is considered adequate for relational database design?[Question ID = 32297][Question Description = Ph.D.SCSH_Q_084]
1. 2NF [Option ID = 185619]
2. 3NF [Option ID = 185620]
3. BCNF [Option ID = 185621]
4. 4NF [Option ID = 185622]

85) Consider the following statements

S1: All-key relation is always in BCNF since it has no FDs.

S2: If a relation schema is in 3NF and each of its keys consists of a single attribute, it is also in 5NF.

S3: Every relation in BCNF is also in 3NF.

Which one of the following is correct?

[Question ID = 32298][Question Description = Ph.D.SCSH_Q_085]
1. S1,S2 true, S3 false

[Option ID = 185623]
2. S1,S3 true, S2 false

[Option ID = 185624]
3. S1,S2 false, S3 true

[Option ID = 185625]
4. S1,S2,S3 true

[Option ID = 185626]

86) The Transmission Control Protocol (TCP) enables a sender to retransmit a packet if it does not receive an acknowledgment from the intended receiver. The retransmission timeout refers to the waiting period for the acknowledgment after sending the packet. Which of the following incorrectly expresses the relationship between the retransmission timeout and the estimated round-trip time (RTT) of the connection between the sender and the receiver? [Question ID = 32299][Question Description = Ph.D.SCSH_Q_086]
1. If the retransmission timeout is shorter than the estimated RTT, the sender would retransmit packets that may not need to be retransmitted. [Option ID = 185627]
2. If the retransmission timeout is significantly larger than the estimated RTT, the sender would take a long time to retransmit and would cause undesirable delay. [Option ID = 185628]
3. If the retransmission timeout is set equal to the expected RTT, the sender would be able to manage optimal values for the number of retransmissions as well as the delay in each retransmission. [Option ID = 185629]
4. If the retransmission timeout is set to a value that is slightly larger than the estimated RTT, the sender would be able to have sufficient margin to compensate for small fluctuations in the estimated RTT. [Option ID = 185630]

87) At the transport layer, the sender needs to perform multiplexing to create a Transmission Control Protocol (TCP) segment to appropriately collect the data coming from different sockets. Similarly, the receiver needs to perform demultiplexing of the TCP segment to correctly direct the relevant data to the corresponding socket. Which of the following statements are correct?

A. The received segment must have the source port number and the source IP address to facilitate demultiplexing.

B. The received segment must have the destination port number and destination Internet Protocol (IP) address to facilitate demultiplexing.

C. The demultiplexing cannot direct the relevant data to two different sockets if the source port numbers in two segments are the same.

D. The demultiplexing can direct the relevant data to two different sockets even in a case where the destination port addresses in two segments are the same.

Choose the correct answer from the options given below:

[Question ID = 32300][Question Description = Ph.D.SCSH_Q_087]
1. A, B and D only

[Option ID = 185631]
2. B and D only

[Option ID = 185632]
3. A and C only

[Option ID = 185633]

4. A only

[Option ID = 185634]

88) Consider a scenario where a sender sends two 1024-bit messages to a receiver on a lossy channel. The sender intends to help the receiver detect any bit error in the received messages. Hence, for the first message, the sender generates an 8-bit cyclic redundancy check (CRC) and transmits it along with the message. For the second message, the sender generates a 16-bit CRC and transmits it along with the message. Which of the following statements is correct?[Question ID = 32301][Question Description = Ph.D.SCSH_Q_088]

1. The receiver can detect only up to four bit errors in the first message. [Option ID = 185635]
2. The receiver can correct up to eight bit errors in the second message. [Option ID = 185636]
3. The receiver can detect burst errors of less than 17 bits in the second message. [Option ID = 185637]
4. The 8-bit CRC or 16-bit CRC is too small to detect any error in a 1024-bit message. [Option ID = 185638]

89) An institute decides to conduct a study to decide whether it should install a web cache to reduce the traffic on its access link to the Internet. The study finds out that within a week of installing the web cache, there will be up to 50% probability that a client within the institute's network would be successfully served by the web cache. Which of the following is not a misleading observation?[Question ID = 32302][Question Description = Ph.D.SCSH_Q_089]

1. Whenever a web cache cannot serve a client's request, it will fetch the content from the original web server over the Internet and provide the content to the client. [Option ID = 185639]
2. The web cache is not a suitable option because the websites keep updating and the clients will have to be directed to the original web servers anyway. [Option ID = 185640]
3. The web cache can only reduce the access link traffic, but cannot reduce the response time of the client's request. [Option ID = 185641]
4. After installing the web cache, the response time to the client's request will be reduced to half. [Option ID = 185642]

90) A domain name system (DNS) is a critical protocol that translates a host's name to its IP address. Which of the following is not correct about DNS?[Question ID = 32303][Question Description = Ph.D.SCSH_Q_090]

1. Even with the distributed hierarchical DNS servers, the client needs to send a single query to the local DNS server for the translation. [Option ID = 185643]
2. The response to a DNS query must consist of only one IP address corresponding to the host. [Option ID = 185644]
3. A DNS server can cache the responses to frequently received DNS queries and serve its clients with faster responses. [Option ID = 185645]
4. DNS itself is an application-layer protocol, but it plays a critical role for realizing other client applications. [Option ID = 185646]

91) Which of the following statements is/are False?

I. For every non-deterministic Turing machine, there exists an equivalent deterministic Turing machine.

II. Turing recognizable languages are closed under union and complementation.

III. Turing decidable languages are closed under intersection and complementation.

IV. Turing recognizable languages are closed under union and intersection.

[Question ID = 32304][Question Description = Ph.D.SCSH_Q_091]

1. I and IV only

[Option ID = 185647]

2. I and III only

[Option ID = 185648]

3. II only

[Option ID = 185649]

4. III only

[Option ID = 185650]

92) Given the language L = {ab, aa, baa}, which of the following strings are in L*?

I. abaabaaabaa

II. aaaabaaaa

III. baaaaabaaaab

IV. baaaaaba

[Question ID = 32305][Question Description = Ph.D.SCSH_Q_092]

1. I, II and III

[Option ID = 185651]

2. II, III and IV

[Option ID = 185652]

3. I, II and IV

[Option ID = 185653]

4. I, III and IV

[Option ID = 185654]

93) The language accepted by pushdown automaton in which the stack is limited to 10 items is the best described as[Question ID = 32306][Question Description = Ph.D.SCSH_Q_093]

1. context-free [Option ID = 185655]
2. regular [Option ID = 185656]
3. deterministic context-free [Option ID = 185657]
4. recursive [Option ID = 185658]

94) For two regular languages

L1 = (a+b)*a and L2 = b(a+b)*

The intersection of L1 and L2 is given by

[Question ID = 32307][Question Description = Ph.D.SCSH_Q_094]

1. (a+b)*ab

[Option ID = 185659]

2. ab(a+b)*

[Option ID = 185660]

3. a(a+b)*b

[Option ID = 185661]

4. b(a+b)*a

[Option ID = 185662]

95) Recursive languages are[Question ID = 32308][Question Description = Ph.D.SCSH_Q_095]

1. a proper superset of context-free languages [Option ID = 185663]
2. also called Type-0 languages [Option ID = 185664]
3. recognizable by Turing machines [Option ID = 185665]
4. all of the above [Option ID = 185666]

96) A function f(x) is linear and has a value of 29 at x = -2 and 39 at x = 3. Then its value at x = 5 is:[Question ID = 32309][Question Description = Ph.D.SCSH_Q_096]

1. 59 [Option ID = 185667]
2. 45 [Option ID = 185668]
3. 43 [Option ID = 185669]
4. 35 [Option ID = 185670]

97) Consider the set S = {1, ω, ω^2}, where ω and ω^2 are cube roots of unity. If * denotes the multiplication operation, the structure (S, *) forms[Question ID = 32310][Question Description = Ph.D.SCSH_Q_097]

1. A group [Option ID = 185671]
2. A ring [Option ID = 185672]
3. An integral domain [Option ID = 185673]
4. A field [Option ID = 185674]

98) From 50 students taking examination in Mathematics, Physics and Chemistry, 37 passed Mathematics, 24 Physics and 43 Chemistry. At most 19 passed Mathematics and Physics; at most 29 passed Mathematics and Chemistry; at most 20 passed Physics and Chemistry. If each student has passed in at least one of the subjects, then the largest number of students who could have passed in all the three subjects is[Question ID = 32311][Question Description = Ph.D.SCSH_Q_098]

1. 18 [Option ID = 185675]

2. 20 [Option ID = 185676]
3. 14 [Option ID = 185677]
4. 16 [Option ID = 185678]

99) Eighteen persons have to be seated, half on each side of a long table. Four particular persons desire to sit on one particular side and three others on the other side. Then the number of ways in which the seating arrangement can be made is

[Question ID = 32312][Question Description = Ph.D.SCSH_Q_099]

1. $\frac{11}{6! \times 5!} \times 9! \times 9!$

   [Option ID = 185679]

2. $\frac{11!}{6! \times 5!}$

   [Option ID = 185680]

3. $\frac{11}{6 \times 5} \times 9 \times 9$

   [Option ID = 185681]

4. $\frac{11}{6! \times 5!} \times 9 \times 9$

   [Option ID = 185682]

100) Which of the following is the negation of the statement "2 is even or -3 is negative"?[Question ID = 27788][Question Description = Ph.D.SCSH_Q_100]

1. 2 is even or -3 is not negative. [Option ID = 185683]
2. 2 is odd or -3 is not negative. [Option ID = 185684]
3. 2 is even and -3 is not negative. [Option ID = 185685]
4. 2 is odd and -3 is not negative. [Option ID = 185686]

101) Which of the following statement is false?

[Question ID = 27789][Question Description = Ph.D.SCSH_Q_101]

1. The number of electrons and number of holes in an intrinsic semiconductor are equal. [Option ID = 185687]
2. The Fermi level of an intrinsic semiconductor lies at the center of the Forbidden energy gap at room temperature. [Option ID = 185688]
3. In an n-type semiconductor material, the free electron concentration is approximately equal to the density of donor atoms. [Option ID = 185689]
4. The conductivity of a semiconductor is proportional to the concentration of free charge carriers. [Option ID = 185690]

102) Two semiconductor materials A and B have carrier concentration values n_A = 1 x 10^{21} m^{-3} and n_B =4 x 10^{21} m^{-3}. Hall coefficients of the materials, R_A and R_B are in the ratio of

[Question ID = 27790][Question Description = Ph.D.SCSH_Q_102]

1. 1:2

   [Option ID = 185691]

2. 2:1

   [Option ID = 185692]

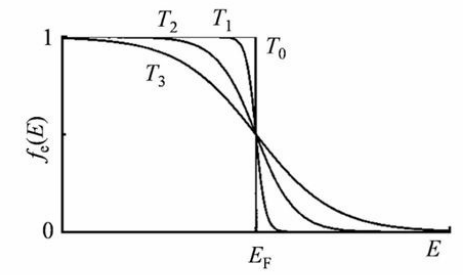
3. 1:4

   [Option ID = 185693]

4. 4:1

   [Option ID = 185694]

103) Fermi Dirac Distribution function is plotted for four different temperatures (T) as labeled in following curve:



Match **List I** with **List II**

List I	**List II**
Temperature	**Curve**
A. 400 K	I. T_0
B. 300 K	II. T_1
C. 50 K	III. T_2
D. 0 K	IV. T_3

Choose the **correct** answer from the options given below:

[Question ID = 27791][Question Description = Ph.D.SCSH_Q_103]

1. A -I , B -II , C - III, D - IV

   [Option ID = 185695]

2. A -I , B -III , C - IV, D -II

   [Option ID = 185696]

3. A -IV , B -III , C -II , D - I

   [Option ID = 185697]

4. A -IV , B -I , C - II, D - III

   [Option ID = 185698]

104) In Silicon at T=300 K, the thermal equilibrium concentration of electron is n_0=5 x 10^4 cm^{-3}. The hole concentration is

[Question ID = 27792][Question Description = Ph.D.SCSH_Q_104]

1. 4.5 x 10^{15} cm^{-3}

   [Option ID = 185699]

2. 4.5 x $10^{15}m^3$

   [Option ID = 185700]

3. 0.3 x $10^{-6}cm^{-3}$

   [Option ID = 185701]

4. 0.3 x 10^{-6} m^{-3}

   [Option ID = 185702]

105) The lattice constant of a face centred cubic structure is 5 Angstrom. What will be the volume charge density in per cm^3?

[Question ID = 27793][Question Description = Ph.D.SCSH_Q_105]

1. 3.2 x 10^{22}

   [Option ID = 185703]

2. 4 x 10^{22}

[Option ID = 185704]

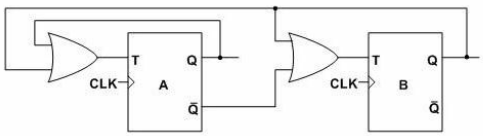
3. 0.8×10^{22}

[Option ID = 185705]

4. 1.6×10^{22}

[Option ID = 185706]

106) What does the figure shown below represent?



[Question ID = 27794][Question Description = Ph.D.SCSH_Q_106]

1. A MOD-2 counter

[Option ID = 185707]

2. A MOD-3 counter

[Option ID = 185708]

3. Generate sequence 00, 10, 01, 00

[Option ID = 185709]

4. Generate sequence 00, 10, 00, 10, 00

[Option ID = 185710]

107) Consider the statements below:

A. If the output waveform from an OR gate is the same as the waveform at one of its inputs, the other input is being held permanently LOW.

B. If the output waveform from an OR gate is always HIGH, one of its input is being held permanently HIGH.

The statement, which is always true, is

[Question ID = 27795][Question Description = Ph.D.SCSH_Q_107]

1. BOTH A and B

[Option ID = 185711]

2. Only A

[Option ID = 185712]

3. Only B

[Option ID = 185713]

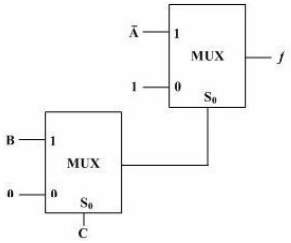
4. None of the statements is TRUE.

[Option ID = 185714]

108) The _____ code has the characteristic that only one bit changes in going from one step to the next.[Question ID = 27796][Question Description = Ph.D.SCSH_Q_108]

1. Hamming [Option ID = 185715]
2. Gray [Option ID = 185716]
3. Binary [Option ID = 185717]
4. BCD [Option ID = 185718]

109) The network shown in Figure below implements a



[Question ID = 27797][Question Description = Ph.D.SCSH_Q_109]

1. NOR gate

[Option ID = 185719]

2. NAND gate

[Option ID = 185720]

3. XOR gate

[Option ID = 185721]

4. XNOR gate

[Option ID = 185722]

110) Consider the following statements:

A. If a logic circuit has a fan-out of 5, the circuit has five outputs.

B. The HIGH-stage noise margin is the difference between V_{IH}(min) and V_{CC}.

C. Unused CMOS inputs in an IC can be left unconnected.

D. TTL is better suited than CMOS for operation in high-noise environments.

E. A TTL output acts as a current sink in the LOW state.

Which of the above statement/s is/are true?

[Question ID = 27798][Question Description = Ph.D.SCSH_Q_110]

1. E only

[Option ID = 185723]

2. A and E only

[Option ID = 185724]

3. B and C only

[Option ID = 185725]

4. B and D only.

[Option ID = 185726]

111) Compared to the lower level metal layers, the thickness of higher level metal layers is:[Question ID = 27799][Question Description = Ph.D.SCSH_Q_111]

1. Larger [Option ID = 185727]
2. Equal [Option ID = 185728]
3. Smaller [Option ID = 185729]
4. Cannot be determined [Option ID = 185730]

112) The process of incorporation of dopants in substrate is : [Question ID = 27800][Question Description = Ph.D.SCSH_Q_112]

1. Deposition [Option ID = 185731]
2. Diffusion [Option ID = 185732]
3. Spin coating [Option ID = 185733]

4. Etching [Option ID = 185734]

113) The DC sputter deposition process is used to deposit _____[Question ID = 27801][Question Description = Ph.D.SCSH_Q_113]

1. Conductive materials [Option ID = 185735]
2. Non-conductive materials [Option ID = 185736]
3. Polymers material [Option ID = 185737]
4. All of 1, 2, and 3 [Option ID = 185738]

114) The patterns are printed on the film using: [Question ID = 27802][Question Description = Ph.D.SCSH_Q_114]

1. Photolithography [Option ID = 185739]
2. Deposition [Option ID = 185740]
3. Implantation [Option ID = 185741]
4. Diffusion [Option ID = 185742]

115) Class 'X' clean room is : [Question ID = 27803][Question Description = Ph.D.SCSH_Q_115]

1. There are less than 'X' particles of greater than 0.5um size in each cubic foot of the room [Option ID = 185743]
2. There are less than 'X' particles of greater than 1 um in each cubic foot of the room [Option ID = 185744]
3. There are less than 'X' particles of greater than 1.5um in each cubic foot of the room [Option ID = 185745]
4. There are less than 'X' particles of greater than 2um in each cubic foot of the room [Option ID = 185746]

116) The film which can be thermally grown on Si substrate is :[Question ID = 27804][Question Description = Ph.D.SCSH_Q_116]

1. Silicon oxide [Option ID = 185747]
2. Silicon Nitride [Option ID = 185748]
3. Silicon carbide [Option ID = 185749]
4. polymer film [Option ID = 185750]

117) Which of the following MEMS micromachining process/processes involves/involve the removal of the substrate part?

[Question ID = 27805][Question Description = Ph.D.SCSH_Q_117]

1. Surface micromachining

   [Option ID = 185751]
2. Bulk micromachining

   [Option ID = 185752]
3. Both Surface micromachining and Bulk micromachining

   [Option ID = 185753]
4. Neither Surface micromachining nor Bulk micromachining

   [Option ID = 185754]

118) Consider the following statements regarding etching out the exposed area:

PR1: Positive photoresist

PR2: Negative photoresist

Which of the following is correct?

[Question ID = 32403][Question Description = Ph.D.SCSH_Q_118]

1. PR1 only

   [Option ID = 185755]
2. PR2 only

   [Option ID = 185756]
3. Both PR1 and PR2

   [Option ID = 185757]
4. Neither PR1 nor PR2

   [Option ID = 185758]

119) The most commonly used substrate for IC technology is :[Question ID = 32404][Question Description = Ph.D.SCSH_Q_119]

1. Silicon [Option ID = 185759]
2. Quartz [Option ID = 185760]
3. GaAs [Option ID = 185761]
4. Germanium [Option ID = 185762]

120) Single crystal Silicon substrate growth technique/s is/are:[Question ID = 32405][Question Description = Ph.D.SCSH_Q_120]

1. Float zone method [Option ID = 185763]
2. Deposition [Option ID = 185764]
3. Oxidation [Option ID = 185765]
4. All of above [Option ID = 185766]

121) The dynamic resistance r_d of a p-n junction for a quiscent value of current I_D = 25mA (the current I_D lies in the vertical section of the I_D-V_D curve) at room temperature is:

[Question ID = 32406][Question Description = Ph.D.SCSH_Q_121]

1. 1.04Ω

   [Option ID = 185767]
2. 2.4Ω

   [Option ID = 185768]
3. 2.08Ω

   [Option ID = 185769]
4. 0.5Ω

   [Option ID = 185770]

122) The transition capacitance is a capacitive effect

[Question ID = 32407][Question Description = Ph.D.SCSH_Q_122]

1. Predominant in the reverse bias region

   [Option ID = 185771]
2. Predominant in the forward bias region

   [Option ID = 185772]
3. That does not affect p-n junction operation

   [Option ID = 185773]
4. Is represented by adding a capacitor C_D in series with the p-n junction

   [Option ID = 185774]

123) The reverse recovery time of a p-n junction type device t_{rr} is

[Question ID = 32408][Question Description = Ph.D.SCSH_Q_123]

1. Storage time, ts

   [Option ID = 185775]
2. Transition time, t_t

   [Option ID = 185776]
3. Sum of storage and transistion time, (t_s+t_t)

   [Option ID = 185777]
4. For most commercial devices, in the range of micro seconds to milli seconds

   [Option ID = 185778]

124) Which of the following statement is incorrect regarding LED?[Question ID = 32409][Question Description = Ph.D.SCSH_Q_124]

1. LED is a diode that operates in the visible as well as the invisible region of the EM spectrum [Option ID = 185779]

2. For Si or Ge diodes, the emitted light is insignificant [Option ID = 185780]
3. For GaAs diodes, the emitted light is in the infrared region [Option ID = 185781]
4. External metallic conducting surface connected to the p-type material of the LED is quite large [Option ID = 185782]

125) Consider a silicon p-n junction at T = 300 K with doping densities $N_a = 10^{18}$ cm^{-3} and $N_d = 10^{15}$ cm^{-3}. Assuming that $n_i = 1.5 \times 10^{10}$ cm^{-3}, the built in voltage, V_{ib} is

[Question ID = 32410][Question Description = Ph.D.SCSH_Q_125]
1. 0.754 Volts

[Option ID = 185783]
2. 0.675 Volts

[Option ID = 185784]
3. 0.635 Volts

[Option ID = 185785]
4. 0.745 Volts

[Option ID = 185786]

126) For a Si based p-n jnuction at T = 300 K with $N_a = 10^{16}$ cm^{-3} and $N_d = 10^{15}$ cm^{-3} , the intrinsic concentration is $n_i = 1.5 \times 10^{10}$ cm^{-3}. If $\varepsilon_s = 11.7\varepsilon_0$ (ε_0 is the permittivity of free space), the space charge width (in μm) is

[Question ID = 32411][Question Description = Ph.D.SCSH_Q_126]
1. 0.951

[Option ID = 185787]
2. 0.915

[Option ID = 185788]
3. 0.722

[Option ID = 185789]
4. 0.645

[Option ID = 185790]

127) Consider a Si based p-n junction at T = 300 K with intrinsic concentration $n_i = 1.5 \times 10^{10}$ cm^{-3}. Assuming the n-type doping is 10^{16} cm^{-3} and forward bias voltage applied to p-n junction is 0.6 Volts, the minority carrier hole concentration at the edge of the space charge region (in cm^{-3}) is

[Question ID = 32412][Question Description = Ph.D.SCSH_Q_127]
1. 2.59×10^{14}

[Option ID = 185791]
2. 2.69×10^{13}

[Option ID = 185792]
3. 2.78×10^{14}

[Option ID = 185793]
4. 3.24×10^{13}

[Option ID = 185794]

128) Which of the following statement is incorrect with respect to CMOS invertor?[Question ID = 32413][Question Description = Ph.D.SCSH_Q_128]
1. CMOS invertor has a high noise margin and noise immunity [Option ID = 185795]
2. CMOS invertor can be very easily fabricated [Option ID = 185796]
3. CMOS invertor has minumum power dissipation [Option ID = 185797]
4. CMOS invertor has a very high fan out capability [Option ID = 185798]

129) In CMOS logic circuit, the n-MOS transistor acts as[Question ID = 32414][Question Description = Ph.D.SCSH_Q_129]
1. Pull up network [Option ID = 185799]
2. Pull down network [Option ID = 185800]
3. Load [Option ID = 185801]
4. Not used in CMOS circuits [Option ID = 185802]

130) When both n-MOS and p-MOS transistors of CMOS logic design are in OFF condition, the output is[Question ID = 32415][Question Description = Ph.D.SCSH_Q_130]
1. High impedance [Option ID = 185803]
2. Low impedance [Option ID = 185804]
3. 1 or Vdd [Option ID = 185805]
4. 0 or GND [Option ID = 185806]

131) "Energy gap depends on _____". Complete the sentence with most suitable option out of the following.[Question ID = 32416][Question Description = Ph.D.SCSH_Q_131]
1. temperature [Option ID = 185807]
2. interatomic spacing [Option ID = 185808]
3. interatomic spacing and mobility of electrons [Option ID = 185809]
4. temperature and interatomic spacing [Option ID = 185810]

132) _____ gives the probability that energy state E will be occupied by a hole.[Question ID = 32417][Question Description = Ph.D.SCSH_Q_132]
1. f(E) -1 [Option ID = 185811]
2. 1+ f(E) [Option ID = 185812]
3. 1 - f(E) [Option ID = 185813]
4. f(E) [Option ID = 185814]

133) A cold mercury vapour absorbs a photon of wavelength 1400 Angstrom and two other photons are emitted. If one of these is the 1800 Angstrom line, what is the wavelength of the second photon?[Question ID = 32418][Question Description = Ph.D.SCSH_Q_133]
1. 796 Angstrom [Option ID = 185815]
2. 6300 Angstrom [Option ID = 185816]
3. 400 Angstrom [Option ID = 185817]
4. 1600 Angstrom [Option ID = 185818]

134) Consider the following statements for n-type semiconductors:

A. Fermi level coincides with the lowest energy level of the conduction band at 0K.

B. As temperature increases, Fermi level moves towards the middle of the bandgap.

C. As donor concentration increases, Fermi level moves towards the lowest energy level of the conduction band.

D. Normally Fermi level lies close to the highest energy level of the valence band.

Choose the correct answer from the options given below:

[Question ID = 32419][Question Description = Ph.D.SCSH_Q_134]
1. A, B and C only

[Option ID = 185819]
2. A, B and D only

[Option ID = 185820]
3. A and B only

[Option ID = 185821]
4. B and C only

[Option ID = 185822]

135) The doner concentration in an n-type semiconductor is 2.5×10^{14} atoms/cm^3. The density of atoms in semiconductor is 5×10^{22} atoms cm^3 when the effective mass of the electrons is assumed to be equal to the true mass. At what temperature will Fermi level coincide with the lowest edge of the conduction band?

[Question ID = 32420][Question Description = Ph.D.SCSH_Q_135]
1. 0.37 K

[Option ID = 185823]
2. 0.02 K

[Option ID = 185824]

3. 0.28 K

[Option ID = 185825]

4. 0.14 K

[Option ID = 185826]

136) "Due to _____ doping, diffusion _____ but net current should be _____". Choose the correct option to fill the respective blanks. [Question ID = 32421][Question Description = Ph.D.SCSH_Q_136]

1. non-uniform, doesn't exist, unbalanced. [Option ID = 185827]
2. non-uniform, exists, zero. [Option ID = 185828]
3. uniform, doesn't exist, zero. [Option ID = 185829]
4. uniform, exists, zero. [Option ID = 185830]

137) Which of the following is a correct statement?[Question ID = 32422][Question Description = Ph.D.SCSH_Q_137]

1. Drift current appears due to variation in carrier concentration and diffusion current appears due to applied electric field over a given distance. [Option ID = 185831]
2. Diffusion current appears due to variation in carrier concentration and drift current appears due to applied electric field over a given distance and carrier concentration. [Option ID = 185832]
3. Both drift and diffusion currents appear due to applied electric field over a given distance. [Option ID = 185833]
4. Both drift and diffusion currents appear due to variation in carrier concentration. [Option ID = 185834]

138) For a field gradient of 100 V/m the drift velocity of holes is observed as 50 m/s. The mobility of holes will be: [Question ID = 27806][Question Description = Ph.D.SCSH_Q_138]

1. 2 (SI Unit) [Option ID = 185835]
2. 1 (SI Unit) [Option ID = 185836]
3. 5 (SI Unit) [Option ID = 185837]
4. 0.5 (SI Unit) [Option ID = 185838]

139) 3.2×10^{15} atoms of a donor impurity are used to dope a uniform semiconductor bar of the volume of 1 cm^3. The intrinsic carrier concentration of this semiconductor at 300 K is 1.6×10^{10} cm^{-3}. The concentration of equilibrium holes for a case of complete impurity ionization is

[Question ID = 27807][Question Description = Ph.D.SCSH_Q_139]

1. 1.25×10^{-5} cm^{-3}

[Option ID = 185839]

2. 0.8×10^{5} cm^{-3}

[Option ID = 185840]

3. 1.6×10^{5} cm^{-3}

[Option ID = 185841]

4. 2×10^{5} cm^{-3}

[Option ID = 185842]

140) For three distinct experiments of scattering in a semiconductor, individual mobility for each experiment is observed as 500 cm2/V-s, 550 cm^2/V-s, and 1500 cm^2/V-s, respectively. The net mobility is

[Question ID = 27808][Question Description = Ph.D.SCSH_Q_140]

1. 250 cm^2/V-s

[Option ID = 185843]

2. 1500 cm^2/V-s

[Option ID = 185844]

3. 2550 cm^2/V-s

[Option ID = 185845]

4. 223 cm^2/V-s

[Option ID = 185846]