Continuing Education Course #275
What Every Engineer Should Know
About Engineering Probability and Statistics I

1. Consider the relationship between probability and statistic. With respect to probability, the reasoning or the process that best describes how to project information from the population to the sample is:
- a. Deduction
- b. Induction
- c. None of the above

2. Sample Statistics can be used to estimate the population parameter using:
- a. Nonmathematical reasoning
- b. Statistical Inference
- c. Probability
- d. Both a and b

3. Big data is used to describe data sets that are so large or complex that traditional data processing applications are inadequate to deal with them
- a. True
- b. False

4. Which of the following about data storage is true?
- a. A Terabyte can hold less than one copy of the Encyclopedia Britannica.
- b. Over 85 million pages of WORD documents would fill one Terabyte
- c. None of the above is true

5. Which of the following about Data Analytics is true?
- a. It is the discovery, interpretation, and communication of meaningful patterns in data.
- b. Data analytics has become an important tool in most engineering disciplines and are especially valuable when there exists rich and large recorded data.
- c. They combine basic theories and applications in the sciences to quantify performance with the ultimate goal of supporting engineering and scientific decision making.
- d. all the above

6. Of the several statistics identified as estimators of the Central Tendency, which one is considered the best estimator.
- a. The Median
- b. The Mode
- c. The Mean
- d. The Mid-range

7. Which two characteristics are used to determine the best estimator of the Central Tendency
- a. Biased and efficient
- b. Unbiased and inefficient

○ c. Unbiased and efficient

8. The Range is used as an estimator of variability (dispersion) when;
○ a. The sample size is large
○ b. The sample size is small (greater than or equal to 2 but less than 5)
○ c. The range is always a good estimator of variability

9. In estimating the variability of a data set with known sample size, when is the Standard Deviation preferred over the Range?
○ a. When the sample size is 5 or more
○ b. When the sample less than 5
○ c. when the sample size is unknown

10. The Inter-quartile range can be used as an estimator of variability
○ a. True
○ b. False

11. Which of the following is a major uncertainty associated with an Engineering Design Problem?
○ a. Parameter uncertainty
○ b. Data uncertainty
○ c. Operational Uncertainty
○ d. All of the above

12. An event is a subset of the sample space. Every subset of a sample space is an event. If we roll a **pair of dice one time**, the sample space S is the set of all 2-tuples, namely:
$S=(X_1, X_2)$: $\{X_1=1, 2, 3,4,5,6; X_2=1, 2,3,4,5,6)\}$.
Define A= Sum of the faces of the two dice is 5
How many elements are contained in the event A?
○ a. 5 elements
○ b. 6 elements
○ c. 4 elements

13. In problem 12, the total number of elements in the Sample Space S is
○ a. 6
○ b. 36
○ c. 12
○ d. 24

14. A Sample Space is defined as the set of all possible outcomes of a random experiment
○ a. True
○ b. False
○ c. No response

15. The domain of a Random Variable is:
○ a. The Range $\mathbb{R}$
○ b. Sample space S
○ c. None of the above

16. What is the definition of a Random Variable?
○ a. A Random Variable is a function that to each sample point in the sample Space S, assigns a number (a real number)

○ b. A rule that maps events on the real line $\mathbb{R}$ to Sample Space S
○ c. both a and b

17. Which of the following is TRUE about the mapping from the Sample Space to the Real line $\mathbb{R}$ and the mapping from the Real line $\mathbb{R}$ to the Sample Space S
○ a. The mapping from the Sample Space S to the Real Line $\mathbb{R}$ is One-to-one and unique, that is, one event can only take on a unique value on the real line $\mathbb{R}$
○ b. The mapping either way is not unique. An event can take different values because it is a random variable.
○ c. The mapping from the real line to the sample space is unique

18. For two events, A and B, P (A∪B) =0.4, P (A∩B) =0.1, P (B) = 0.2. What is P (A)?, namely, the probability of the event A
○ a. P (A)= 0.4
○ b. P (A)= 0.3
○ c. P (A) = 0.1
○ d. None of the above

19. For problem 18, the two events A and B are
○ a. Mutually Exclusive
○ b. Mutually Independent
○ c. Not Mutually Exclusive

20. For two events A and B, P(A?B) =P(A), P(B?A) =P(B). Hence events A and B are:
○ a. Mutually Exclusive
○ b. Independent
○ c. None of a or b

21. The Binomial Distribution has only two possible outcomes
○ a. True
○ b. False

22. A distribution has a Binomial distribution with n=5, and p=0.1. What is the probability of getting an outcome X=0, that is, P(X=0)
○ a. 0
○ b. $(0.1)^4$
○ c. $(0.1)^5$
○ d. $(0.9)^5$

23. For the Negative Binomial Distribution, the random variable of **interest** is the number of trials required to achieve a given outcome
○ a. True
○ b. False

24. For the Geometric Distribution, the Random variable of **interest** is:
○ a. The number of trials until the 1st desired outcome
○ b. The number of trials until the r^{th} desired outcome
○ c. None of a or b

25. For the Poisson distribution
○ a. The Mean and Standard Deviation are NOT equal
○ b. The Variance is equal to the Standard Deviation

○ c. The Mean is equal to the Variance

26. For the Poisson distribution assume that the average number of defects per unit area μ is 0.05. If the area under consideration is 20 square units, what is the average number of defects for the given area?

○ a. μ=0.05
○ b. μ=0.25
○ c. μ=1.00
○ d. μ=0.025

27. For the Exponential distribution, the random variable of interest is:

○ a. The same as the Normal distribution
○ b. The time between the occurrences of the event
○ c. There is a reciprocal relationship between the Exponential parameter (the random variable) and the Poisson parameter
○ d. b and c

28. For the Normal Distribution

○ a. The Mode, the Mean, and the Median are ALL equal
○ b. The Mean and the Median are not equal
○ c. The Mode and the Median are not equal

29. The Value of Z (the Number of Standard deviates or the number of Standard Normal deviates) corresponding to 0.975 (or 97.5%) is 1.96.
What is the Z value corresponding to 0.025 (or 2.5%)?

○ a. 1.96
○ b. -1.96
○ c. The same as the Z values correspond to 1-(0.975+0.0125 =0.9875)= approx 2.25
○ d. None of the values given is correct.

30. The Uniform distribution (also known as the Rectangular distribution) has the limits or endpoints equal to A and B, where A=(-8) and B= 20. What is the mean of μ of this distribution?

○ a. 0
○ b. 6
○ c. 1