Continuing Education Course #398
Engineering Methods in Microsoft Excel
Part 4: Simulation and Systems Modelling I

1. Which of the following is false?
○ a. Simulation involves the experimentation or modelling of a system or process, on a computer, using mathematical models.
○ b. Simulation is useful if the direct experimentation of a system is infeasible.
○ c. None of the above.

2. If the elements of a system being simulated exhibit random behavior that is taken into consideration, the simulation is called
○ a. Casino simulation
○ b. Monte Carlo simulation.
○ c. Las Vegas simulation.

3. System analyses in which the performance of the elements of the system are considered to be set and fixed is described as being
○ a. unidimensional
○ b. deterministic
○ c. multidimensional

4. In simulation, the performance characteristics of the elements of a system that are subject to random chance, are described by
○ a. risk factors
○ b. utility functions
○ c. probability distributions

5. What is a random variable?
○ a. A variable that yields a single numerical value that is determined by chance, for each outcome.
○ b. A function that yields a unique numerical value, determined by chance, for each outcome of an experiment.
○ c. None of the above.

6. An example of a random variable is
○ a. the percentage of defective parts produced by a manufacturing process.
○ b. the number of rear-end crashes at the intersection of two city highways.
○ c. All of the above.

7. Random variables can be broadly classified as being
○ a. linear or nonlinear
○ b. expectation or variance
○ c. discrete or continuous

8. Examples of discrete distributions include

- a. Binomial, Poisson, Geometric, Multinomial
- b. Geeta, Katz, Waring, Zeta
- c. All of the above

9. A state highway authority, by policy, maintains 85% of all its bridges in acceptable condition. An inspector inspects 35 bridges. What is the probability that the inspector will find exactly 25 bridges to be in acceptable condition?
- a. 0.018
- b. 0.039
- c. 0.188

10. A state highway authority, by policy, maintains 85% of all its bridges in acceptable condition. An inspector inspects 35 bridges. What is the probability that the inspector will find no more than 25 bridges to be in acceptable condition?
- a. 0.029
- b. 0.068
- c. 0.971

11. A state highway authority, by policy, maintains 85% of all its bridges in acceptable condition. An inspector inspects 35 bridges. What is the probability that the inspector will find 30 or more bridges to be in acceptable condition?
- a. 0.568
- b. 0.431
- c. 0.368

12. The number of calls for customer assistance at a call center follows a Poisson distribution with an average of 9 calls per hour. What is the probability of exactly 5 calls in an hour?
- a. 0.02
- b. 0.03
- c. 0.06

13. The number of calls for customer assistance at a call center follows a Poisson distribution with an average of 9 calls per hour. What is the probability of 12 or more calls in thirty minutes?
- a. 0.0008
- b. 0.002
- c. 0.001

14. The number of calls for customer assistance at a call center follows a Poisson distribution with an average of 9 calls per hour. The 95th percentile number of calls per hour is approximately
- a. 12
- b. 14
- c. 15

15. For continuous random variables, the distribution function is commonly called the
- a. continuity function
- b. mass function
- c. density function

16. What is a quantile function?
- a. The inverse of the density function.
- b. The reciprocal of the cumulative density function
- c. The inverse of the cumulative density function.

17. Examples of continuous distributions include

○ a. Normal, Poisson, Uniform, Exponential
○ b. Hypergeometric, Weibull, Logistic, Triangular
○ c. Lognormal, Beta, Cauchy, Loglogistic

Use the Excel Workbook provided with the test to conduct the calculations required to answer Question 18 through Question 29.

18. A production engineer determined that an automated cutting device produces bars whose lengths range from 63 mm to 71 mm. If the bars lengths are uniformly distributed, the probability that a bar length will be less than 65 mm is
○ a. 0.25
○ b. 0.35
○ c. 0.45

19. A production engineer determined that an automated cutting device produces bars whose lengths range from 63 mm to 71 mm. If the bars lengths are uniformly distributed, the 90th percentile bar length is approximately
○ a. 70 mm
○ b. 63 mm
○ c. 59 mm

20. An engineer reviewed the history of a routine maintenance activity conducted on an industrial machine. The engineer worked out that on the average there was a downtime of 37 minutes with a standard deviation of 9 minutes. If the downtime is normally distributed, the probability of a downtime of less than 25 minutes is
○ a. 0.091
○ b. 0.908
○ c. 0.910

21. An engineer reviewed the history of a routine maintenance activity conducted on an industrial machine. The engineer worked out that on the average there was a downtime of 37 minutes with a standard deviation of 9 minutes. If the downtime is normally distributed, the probability of a downtime of more than 45 minutes is
○ a. 0.187
○ b. 0.812
○ c. 0.871

22. An engineer reviewed the history of a routine maintenance activity conducted on an industrial machine. The engineer worked out that on the average there was a downtime of 37 minutes with a standard deviation of 9 minutes. If the downtime is normally distributed, the probability of a downtime of between 35 minutes and 40 minutes is
○ a. 0.218
○ b. 0.631
○ c. 0.412

23. An engineer reviewed the history of a routine maintenance activity conducted on an industrial machine. The engineer worked out that on the average there was a downtime of 37 minutes with a standard deviation of 9 minutes. If the downtime is normally distributed, the 85th percentile downtime is approximately
○ a. 28 minutes
○ b. 37 minutes
○ c. 46 minutes

24. The service life (in hours) of an industrial nozzle follows a lognormal distribution with parameters $\alpha = 4.15$, $\beta = 0.32$. The probability that a nozzle can be in service for up to 80 hours is
○ a. 0.943
○ b. 0.765
○ c. 0.235

25. The service life (in hours) of an industrial nozzle follows a lognormal distribution with parameters $\alpha = 4.15$, $\beta = 0.32$. The 95th percentile service life is approximately

- a. 117 hours
- b. 107 hours
- c. 100 hours

26. The lifetime (in thousand-hours) of an automobile part follows a Weibull distribution with parameters $\alpha = 3.25$, $\beta = 20.65$. The probability that the automobile part can last more 25 thousand-hours is

- a. 0.845
- b. 0.155
- c. 0.001

27. The lifetime (in thousand-hours) of a machine part follows a Weibull distribution with parameters $\alpha = 3.25$, $\beta = 0.20.65$. The 98th percentile lifetime of this part is approximately

- a. 29 thousand-hours
- b. 31 thousand-hours
- c. 34 thousand-hours

28. An agriculture engineer works out that a specially cultivated cocoa plant produces pods that have an average weight of 550 grams with a standard deviation of 25 grams. The weight of the cocoa pods follows a logistic distribution. The probability that a cocoa pod weighs more than 600 grams is

- a. 0.119
- b. 0.250
- c. 0.881

29. An agriculture engineer works out that a specially cultivated cocoa plant produces pods that have an average weight of 550 grams with a standard deviation of 25 grams. The weight of the cocoa pods follows a logistic distribution. The 95th percentile cocoa pod weight is approximately

- a. 673 grams
- b. 638 grams
- c. 624 grams