

PRACTICE EXAM 10: FE INDUSTRIAL AND SYSTEMS SIMULATION (110 QUESTIONS)

This practice exam contains 110 questions. Allow 5 hours and 20 minutes of testing time within a 6-hour appointment, including the tutorial, nondisclosure agreement, and scheduled break. Use the supplied FE Reference Handbook where appropriate. NCEES does not publish a fixed passing score; score this practice test diagnostically by domain.

1. A rectangular storage area is 18 m long and 7 m wide. What is its area? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.9730 utilization
- B. 0.9637 utilization
- C. 0.9760 utilization
- D. 0.9690 utilization

2. For $f(x)=3x^2+4x-2$, what is $f'(5)$? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.8230 utilization
- B. 0.8006 utilization
- C. 0.7716 utilization
- D. 0.8409 utilization

3. What is the determinant of the matrix $[[6,2],[3,5]]$? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.6747 utilization
- B. 0.5971 utilization

- C. 0.6400 utilization
 - D. 0.7034 utilization

4. Evaluate the definite integral of $4x$ from $x=1$ to $x=4$. The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.6590 utilization
- B. 0.6233 utilization
- C. 0.5794 utilization
- D. 0.6885 utilization

5. A vector has components 9 and 12. What is its magnitude? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.3600 utilization
- B. 0.4007 utilization
- C. 0.3141 utilization
- D. 0.4369 utilization

6. An arithmetic sequence begins at 5 and increases by 3. What is its 12th term? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.9144 utilization
- B. 0.8868 utilization
- C. 0.9237 utilization
- D. 0.9025 utilization

7. What is the volume of a cylinder with radius 2 m and height 5 m, using $\pi=3.1416$? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.8978 utilization
- B. 0.8839 utilization
- C. 0.8655 utilization
- D. 0.9088 utilization

8. A 24 V source is applied across an 8 Ω resistor. What current flows? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.1600 utilization
- B. 0.0625 utilization
- C. 0.2066 utilization
- D. 0.1111 utilization

9. A 10 kg cart travels at 4 m/s. What is its kinetic energy? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.8264 utilization
- B. 0.8464 utilization
- C. 0.8006 utilization
- D. 0.8622 utilization

10. A 30 kN axial load acts on a 600 mm² section. What is the normal stress? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.7257 utilization
- B. 0.6553 utilization
- C. 0.6944 utilization
- D. 0.7511 utilization

11. Water flows at 2.5 m/s through a 0.08 m² section. What is the volumetric flow rate? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

A. 0.1406 utilization

B. 0.0083 utilization

C. 0.0816 utilization

D. 0.2744 utilization

12. An engineer discovers that a subcontractor's calibration certificate has expired. What should happen before relying on the measurements?

- A. Accept the data because the instrument still powers on
- B. Change the expiration date in the project file
- C. Verify calibration status and repeat affected measurements with properly controlled equipment as necessary
- D. Assume calibration matters only after a failure

13. A client asks an engineer to omit a known operational limitation from equipment instructions. What is the best response?

- A. Omit it because trained operators will discover it
- B. Replace the limitation with promotional language
- C. Mention it only in an unpublished internal memorandum
- D. Refuse the omission and communicate the limitation accurately to affected users

14. An engineer is evaluating two alternatives but owns intellectual property used by one option. What should the engineer do?

- A. Disclose the interest and arrange impartial review or informed conflict management
- B. Conceal ownership until after the recommendation
- C. Assign every benefit to the owned alternative
- D. Exclude competing technical data from the evaluation

15. A project report relies on a small, nonrepresentative sample. How should the engineer describe the conclusion?

- A. Explain the sampling limitation and restrict conclusions to what the evidence supports
- B. Generalize the result to every possible condition
- C. Describe the estimate as exact and universally valid
- D. Delete the sample description from the report

16. An investment of \$5,000 earns 6% annually for 3 years. What is its future value? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.9994 utilization
- B. 0.9992 utilization
- C. 0.9995 utilization
- D. 0.9993 utilization

17. What is the present worth of \$10,000 received 4 years from now at 5% annual interest? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.9290 utilization
- B. 0.9992 utilization
- C. 0.9990 utilization
- D. 0.9989 utilization

18. A product sells for \$50, variable cost is \$30, and fixed cost is \$40,000. What is break-even volume? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.9948 utilization
- B. 0.9940 utilization
- C. 0.9930 utilization
- D. 0.9954 utilization

19. Equipment costs \$72,000, has \$12,000 salvage value, and a 5-year life. What is annual straight-line depreciation? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.9988 utilization
- B. 0.9987 utilization
- C. 0.9984 utilization
- D. 0.9990 utilization

20. A \$90,000 project returns \$18,000 per year. Ignoring interest, what is its simple payback period? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.1406 utilization
- B. 0.0816 utilization
- C. 0.1696 utilization
- D. 0.1111 utilization

21. Annual fixed cost is \$24,000 and output is 8,000 units. What fixed cost is allocated per unit? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.4444 utilization
- B. 0.2500 utilization
- C. 0.3600 utilization
- D. 0.5102 utilization

22. A machine saves \$15,000 annually but costs \$60,000. What is the simple annual return percentage? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.7432 utilization
- B. 0.7706 utilization
- C. 0.7083 utilization

D. 0.7928 utilization

23. A project has benefits of \$140,000 and costs of \$100,000 in equivalent present worth. What is its benefit-cost ratio? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

A. 0.0816 utilization

B. 0.0039 utilization

C. 0.1308 utilization

D. 0.0358 utilization

24. An item costs \$80 after a 20% price reduction. What was its original price? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

A. 0.8741 utilization

B. 0.8354 utilization

C. 0.8573 utilization

D. 0.8874 utilization

25. A replacement reduces annual operating cost from \$48,000 to \$33,000. What is the annual savings? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

A. 0.9988 utilization

B. 0.9987 utilization

C. 0.9984 utilization

D. 0.9990 utilization

26. A fair coin is tossed 4 times. What is the probability of exactly 2 heads? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.0249 utilization
 - B. 0.1660 utilization
 - C. 0.0567 utilization
 - D. 0.2947 utilization
27. A distribution has values 4, 7, 9, and 12. What is the arithmetic mean? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?
- A. 0.4858 utilization
 - B. 0.4444 utilization
 - C. 0.3964 utilization
 - D. 0.5216 utilization
28. A normal observation is 70 with mean 58 and standard deviation 6. What is its z-score? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?
- A. 0.1111 utilization
 - B. 0.0204 utilization
 - C. 0.0625 utilization
 - D. 0.1600 utilization
29. Independent events have probabilities 0.30 and 0.40. What is the probability both occur? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?
- A. 0.0002 utilization
 - B. 0.0151 utilization
 - C. 0.0098 utilization
 - D. 0.0439 utilization
30. A defect rate is 0.02. In 200 independent items, what is the expected number defective? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.1111 utilization
- B. 0.0533 utilization
- C. 0.1406 utilization
- D. 0.0816 utilization

31. For data 2, 5, 8, 11, what is the population variance? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.7209 utilization
- B. 0.7501 utilization
- C. 0.6840 utilization
- D. 0.7739 utilization

32. A sample mean is 40, population σ is 8, and $n=64$. What is the standard error? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.1111 utilization
- B. 0.0000 utilization
- C. 0.0400 utilization
- D. 0.1837 utilization

33. A regression model is $y=12+3x$. What value is predicted when $x=7$? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.7456 utilization
- B. 0.7160 utilization
- C. 0.6786 utilization
- D. 0.7697 utilization

34. How many distinct pairs can be selected from 10 items? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

38. A single-server system has arrival rate 6 per hour and service rate 10 per hour. What is utilization? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.0443 utilization
- B. 0.0039 utilization
- C. 0.0914 utilization
- D. 0.0083 utilization

39. A payoff is \$100 with probability 0.7 and \$20 with probability 0.3. What is expected payoff? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.8393 utilization
- B. 0.7918 utilization
- C. 0.8558 utilization
- D. 0.8186 utilization

40. A simulation uses $u=0.64$ with exponential mean 5. Using $x=-5 \ln(1-u)$, what variate results? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.1143 utilization
- B. 0.0443 utilization
- C. 0.1438 utilization
- D. 0.0848 utilization

41. For constraint $3x+2y \leq 30$, how much slack exists at $x=4$ and $y=6$? Using reference 2, compute squared utilization $= [m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.6049 utilization
- B. 0.5625 utilization
- C. 0.5102 utilization
- D. 0.6400 utilization

42. A Markov state has outgoing probabilities 0.55, 0.25, and p . What is p ? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.0533 utilization
- B. 0.0278 utilization
- C. 0.0023 utilization
- D. 0.1259 utilization

43. A database query returns 240 rows from 1,200 records. What percentage is returned? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.6290 utilization
- B. 0.5463 utilization
- C. 0.6602 utilization
- D. 0.5917 utilization

44. An algorithm performs 12 comparisons for each of 75 records. How many comparisons occur? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.9825 utilization
- B. 0.9847 utilization
- C. 0.9794 utilization
- D. 0.9865 utilization

45. A weighted score uses weights 0.4, 0.35, 0.25 and ratings 80, 70, 90. What is the score? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.8115 utilization
- B. 0.7879 utilization

D. 0.8304 utilization

46. A model predicts 105 and the observed value is 98. What is the absolute error? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

A. 0.6416 utilization

B. 0.6049 utilization

C. 0.5601 utilization

D. 0.6721 utilization

47. A project path contains activities of 3, 7, 4, and 6 days. What is the path duration? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

A. 0.7257 utilization

B. 0.6553 utilization

C. 0.6944 utilization

D. 0.7511 utilization

48. Planned value is \$80,000 and earned value is \$72,000. What is schedule variance? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

A. 0.9985 utilization

B. 0.9982 utilization

C. 0.9987 utilization

D. 0.9979 utilization

49. Earned value is \$90,000 and actual cost is \$100,000. What is cost performance index? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.0368 utilization
- B. 0.0002 utilization
- C. 0.0102 utilization
- D. 0.0708 utilization

50. A team produces 360 units in 45 labor-hours. What is labor productivity? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.2296 utilization
- B. 0.1638 utilization
- C. 0.2599 utilization
- D. 0.1975 utilization

51. PERT estimates are optimistic 4, most likely 7, and pessimistic 16 days. What is expected duration? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.6400 utilization
- B. 0.6747 utilization
- C. 0.5971 utilization
- D. 0.7034 utilization

52. A project has budget at completion \$250,000 and CPI 0.80. What is the basic estimate at completion? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.9300 utilization
- B. 0.8600 utilization
- C. 0.7900 utilization
- D. 1.0000 utilization

53. A decision yields \$60,000 with probability 0.6 and loses \$10,000 with probability 0.4. What is expected value? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.9997 utilization
- B. 0.8596 utilization
- C. 0.9996 utilization
- D. 0.7896 utilization

54. A department completes 950 conforming orders from 1,000 total. What is its conformance KPI? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.8682 utilization
- B. 0.8507 utilization
- C. 0.8278 utilization
- D. 0.8820 utilization

55. A task has latest start day 18 and earliest start day 14. What is total slack? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.1111 utilization
- B. 0.0533 utilization
- C. 0.1406 utilization
- D. 0.0816 utilization

56. A line makes 480 units during an 8-hour shift. What is average throughput? Using reference 2, compute squared utilization $= [m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.9365 utilization
- B. 0.9445 utilization
- C. 0.9260 utilization
- D. 0.9506 utilization

57. A station has 45 minutes of work content and a 9-minute cycle time. What is the theoretical minimum number of stations? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.3600 utilization
- B. 0.2500 utilization
- C. 0.3086 utilization
- D. 0.4050 utilization

58. Demand is 1,600 units/year, order cost is \$25, and holding cost is \$2/unit-year. What is EOQ? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.9498 utilization
- B. 0.9426 utilization
- C. 0.9330 utilization
- D. 0.9554 utilization

59. Forecasts use $\alpha=0.30$, prior forecast 100, and actual demand 120. What is the new exponential-smoothing forecast? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.8806 utilization
- B. 0.8436 utilization
- C. 0.8933 utilization
- D. 0.8646 utilization

60. What is the three-period moving average of demands 90, 105, and 120? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.8529 utilization

B. 0.8336 utilization
C. 0.8086 utilization
D. 0.8681 utilization

61. A machine operates 420 minutes of a planned 480 minutes. What is availability? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

A. 0.9558 utilization
B. 0.9614 utilization
C. 0.9483 utilization
D. 0.9657 utilization

62. A process has availability 0.90, performance 0.95, and quality 0.98. What is OEE? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

A. 0.9219 utilization
B. 0.8965 utilization
C. 0.9109 utilization
D. 0.9304 utilization

63. A batch of 500 pieces includes 15 defective pieces. What is first-pass yield? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

A. 0.9005 utilization
B. 0.8869 utilization
C. 0.8689 utilization
D. 0.9112 utilization

64. Setup is reduced from 50 minutes to 35 minutes. What is the reduction percentage? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.6590 utilization
- B. 0.5794 utilization
- C. 0.6233 utilization
- D. 0.6885 utilization

65. A bottleneck produces one unit every 6 minutes. What is its hourly capacity? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.2500 utilization
- B. 0.2861 utilization
- C. 0.2111 utilization
- D. 0.3195 utilization

66. A department moves 30 loads over 12 m. What is its load-distance contribution? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.9904 utilization
- B. 0.9871 utilization
- C. 0.9915 utilization
- D. 0.9890 utilization

67. Demand is 240 units/day and one machine makes 60 units/day. Ignoring downtime, how many machines are required? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.3086 utilization
- B. 0.2500 utilization
- C. 0.1837 utilization
- D. 0.3600 utilization

68. Average demand is 50 units/day and lead time is 6 days. With no safety stock, what is reorder point? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

72. A truck carries 18 pallets per trip. How many pallets are moved in 14 full trips? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.9730 utilization
- B. 0.9637 utilization
- C. 0.9760 utilization
- D. 0.9690 utilization

73. Supplier lead times are 4, 6, 5, and 9 days. What is the average lead time? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.2899 utilization
- B. 0.2500 utilization
- C. 0.2066 utilization
- D. 0.3265 utilization

74. A facility uses 72,000 ft² of its 90,000 ft² available area. What is space utilization? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.8464 utilization
- B. 0.8006 utilization
- C. 0.8264 utilization
- D. 0.8622 utilization

75. A shipment of 2,400 kg is split equally among 6 destinations. What mass goes to each? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.9579 utilization
- B. 0.9518 utilization
- C. 0.9437 utilization
- D. 0.9626 utilization

76. A task cycle is 50 seconds, including 8 seconds of unavoidable delay. What percentage is delay? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.8135 utilization
- B. 0.7600 utilization
- C. 0.7901 utilization
- D. 0.8323 utilization

77. A display has 96 correct readings in 120 trials. What is reading accuracy? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.9184 utilization
- B. 0.8920 utilization
- C. 0.9273 utilization
- D. 0.9070 utilization

78. A worker exerts 180 N at a perpendicular moment arm of 0.40 m. What joint moment results? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.8521 utilization
- B. 0.8694 utilization
- C. 0.8294 utilization
- D. 0.8831 utilization

79. A population measurement has mean 170 cm and standard deviation 8 cm. What value is two standard deviations above the mean? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.9292 utilization
- B. 0.9060 utilization
- C. 0.9192 utilization

87. Work sampling finds 315 working observations among 420 observations. What is utilization? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.9133 utilization
- B. 0.8854 utilization
- C. 0.9013 utilization
- D. 0.9227 utilization

88. A task takes 20 minutes initially. Under an 80% learning curve, what is the average time per unit after output doubles once? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.5687 utilization
- B. 0.5289 utilization
- C. 0.4815 utilization
- D. 0.6024 utilization

89. A five-step method has times 1.2, 0.8, 2.1, 1.4, and 0.5 minutes. What is cycle time? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.2178 utilization
- B. 0.1479 utilization
- C. 0.2500 utilization
- D. 0.1837 utilization

90. A worker produces 72 units during 6 productive hours. What is observed production rate? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.2975 utilization
- B. 0.3362 utilization

- A. 0.0789 utilization
- B. 0.0348 utilization
- C. 0.0004 utilization
- D. 0.0089 utilization

95. A p-chart has $\bar{p}=0.04$ and $n=400$. What is the three-sigma upper control limit? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.0700 utilization
- B. 0.0000 utilization
- C. 0.0093 utilization
- D. 0.0072 utilization

96. A sample has defect counts 3, 5, 4, and 8. What is the average count? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.5625 utilization
- B. 0.4444 utilization
- C. 0.6049 utilization
- D. 0.5102 utilization

97. A Taguchi loss constant is 4 and deviation from target is 3. What is the quality loss? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.8316 utilization
- B. 0.7822 utilization
- C. 0.8100 utilization
- D. 0.8487 utilization

98. A process yields 970 conforming units out of 1,000. What is percent defective? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.1111 utilization
- B. 0.1600 utilization
- C. 0.0625 utilization
- D. 0.2066 utilization

99. The center line is 25 and the average range is 4. Using $A_2=0.58$, what is the $\bar{X}$ -bar upper control limit? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.6353 utilization
- B. 0.5532 utilization
- C. 0.5983 utilization
- D. 0.6661 utilization

100. A lot has 12 defects in 600 opportunities. What is defects per million opportunities? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.9991 utilization
- B. 0.9990 utilization
- C. 0.9988 utilization
- D. 0.9992 utilization

101. A process improves yield from 88% to 94%. What is the percentage-point increase? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.5625 utilization
- B. 0.6049 utilization
- C. 0.5102 utilization
- D. 0.6400 utilization

102. Two independent series components have reliabilities 0.95 and 0.90. What is system reliability? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.1004 utilization
- B. 0.0012 utilization
- C. 0.1735 utilization
- D. 0.0310 utilization

103. Two independent parallel components each have reliability 0.80. What is system reliability? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.0606 utilization
- B. 0.0000 utilization
- C. 0.1091 utilization
- D. 0.0190 utilization

104. A repairable system has MTBF 900 h and MTTR 100 h. What is inherent availability? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.0102 utilization
- B. 0.0368 utilization
- C. 0.0002 utilization
- D. 0.0708 utilization

105. An FMEA item has severity 8, occurrence 5, and detection 4. What is its RPN? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.8996 utilization
- B. 0.8858 utilization
- C. 0.8677 utilization
- D. 0.9104 utilization

106. A system operates 1,920 h and is down 80 h. What is observed availability? Using reference 2, compute squared utilization= $[m/(m+r)]^2$, where m is raw magnitude. What score results?

- A. 0.9647 utilization
- B. 0.9527 utilization
- C. 0.9596 utilization
- D. 0.9687 utilization

107. Three series elements each have reliability 0.98. What is total reliability? A dashboard squares the ratio of magnitude to magnitude plus reference. Use reference 4. What utilization score is obtained?

- A. 0.1063 utilization
- B. 0.0363 utilization
- C. 0.1068 utilization
- D. 0.0002 utilization

108. A requirement set contains 240 requirements, of which 228 pass verification. What is verification completion? Transform the raw answer with $(|x|/(|x|+6))^2$. What dimensionless squared score is reported?

- A. 0.8847 utilization
- B. 0.8986 utilization
- C. 0.8665 utilization
- D. 0.9095 utilization

109. A component accumulates 12 failures over 6,000 operating hours. What is failure rate per 1,000 hours? The reporting metric is the square of $m/(m+r)$, with $r=8$. What bounded metric results?

- A. 0.0744 utilization
- B. 0.0123 utilization

- C. 0.0400 utilization
- D. 0.1111 utilization

110. A life-cycle alternative costs \$120,000 initially and \$18,000 annually for 5 years, ignoring discounting. What is total life-cycle cost? For reference 10, calculate magnitude divided by magnitude plus reference, then square the ratio. What value results?

- A. 0.9299 utilization
- B. 0.8599 utilization
- C. 0.7899 utilization
- D. 0.9999 utilization

Practice Exam 10: Answer Key and Explanations

1. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.9690. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

2. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.8006. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

3. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.6400. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

4. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.6233. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

5. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.3600. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

6. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.9025. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

7. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.8839. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

8. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.1111. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

9. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.8264. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

10. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.6944. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

11. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.0083. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

12. C — C is correct. Expired calibration creates uncertainty about measurement traceability, requiring verification and possible remeasurement before the data support engineering decisions. The distractors ignore measurement control, conceal limits or interests, or exaggerate conclusions beyond the sample. Applying competence, communication, objectivity, and evidence limits identifies the response that creates a record and protects those relying on the engineering work.

13. D — D is correct. Known limitations that affect use must be communicated accurately; concealing them can create unsafe reliance and misleading instructions. The distractors ignore measurement control, conceal limits or interests, or exaggerate conclusions beyond the sample. Applying competence, communication, objectivity, and evidence limits identifies the response that creates a record and protects those relying on the engineering work.

14. A — A is correct. Ownership creates a financial interest that may affect or appear to affect objectivity, requiring disclosure and appropriate independent safeguards. The distractors ignore measurement control, conceal limits or interests, or exaggerate conclusions beyond the sample.

Applying competence, communication, objectivity, and evidence limits identifies the response that creates a record and protects those relying on the engineering work.

15. A — A is correct. A nonrepresentative sample limits inference, so conclusions must be qualified to avoid overstating what the evidence can establish. The distractors ignore measurement control, conceal limits or interests, or exaggerate conclusions beyond the sample. Applying competence, communication, objectivity, and evidence limits identifies the response that creates a record and protects those relying on the engineering work.

16. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.9993. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

17. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.9990. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

18. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.9940. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

19. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.9987. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

20. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.1111. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

21. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.3600. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

22. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.7432. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

23. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization

score is 0.0358. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

24. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.8573. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

25. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.9987. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

26. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.0249. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

27. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.4444. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

28. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.0625. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

29. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.0002. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

30. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.0816. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

31. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.7209. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

32. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization

score is 0.0400. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

33. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.7160. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

34. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.7209. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

35. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.0032. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

36. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.8336. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

37. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.8920. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

38. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.0083. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

39. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.8186. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

40. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.1143. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

41. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization

score is 0.5625. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

42. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.0023. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

43. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.5917. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

44. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.9825. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

45. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.7879. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

46. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.6049. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

47. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.6944. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

48. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.9985. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

49. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.0102. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

50. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization

score is 0.1975. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

51. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.6400. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

52. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 1.0000. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

53. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.9996. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

54. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.8507. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

55. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.0816. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

56. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.9365. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

57. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.3086. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

58. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.9426. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

59. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization

score is 0.8646. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

60. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.8336. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

61. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.9558. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

62. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.9109. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

63. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.8869. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

64. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.6233. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

65. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.2500. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

66. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.9890. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

67. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.2500. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

68. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization

score is 0.9612. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

69. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.7785. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

70. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.1975. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

71. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.5102. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

72. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.9690. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

73. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.2500. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

74. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.8264. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

75. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.9518. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

76. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.7901. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

77. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization

score is 0.9070. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

score is 0.7710. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

87. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.9013. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

88. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.5289. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

89. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.1837. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

90. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.2975. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

91. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.9246. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

92. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.6944. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

93. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.0204. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

94. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.0089. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

95. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization

score is 0.0102. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

105. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.8858. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

106. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 2, then square the ratio. The bounded squared-utilization score is 0.9596. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

107. B — B is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 4, then square the ratio. The bounded squared-utilization score is 0.0363. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

108. A — A is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 6, then square the ratio. The bounded squared-utilization score is 0.8847. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

109. C — C is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 8, then square the ratio. The bounded squared-utilization score is 0.0400. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.

110. D — D is correct. Compute the raw engineering answer and use its magnitude. Divide that magnitude by the sum of itself and reference 10, then square the ratio. The bounded squared-utilization score is 0.9999. The distractors result from using an incorrect raw answer, omitting the reference, failing to square, or reversing the ratio.