

PRACTICE EXAM 7: 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? With reference 2, compute attainment= $\frac{\text{raw result}}{(\text{r} + \text{raw result})}$. What bounded attainment score results?

- A. 0.9844 attainment
- B. 0.9864 attainment
- C. 0.9817 attainment
- D. 0.9879 attainment

2. For $f(x) = 3x^2 + 4x - 2$, what is $f'(5)$? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.9287 attainment
- B. 0.9189 attainment
- C. 0.9060 attainment
- D. 0.9364 attainment

3. What is the determinant of the matrix $\begin{bmatrix} 6 & 2 \\ 3 & 5 \end{bmatrix}$? Transform the ordinary answer using $|x|/(4 + |x|)$. What dimensionless attainment value is reported?

- A. 0.8571 attainment
- B. 0.8734 attainment

- C. 0.8361 attainment
- D. 0.8864 attainment

4. Evaluate the definite integral of $4x$ from $x=1$ to $x=4$. The reporting scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.8734 attainment
- B. 0.8361 attainment
- C. 0.8571 attainment
- D. 0.8864 attainment

5. A vector has components 9 and 12. What is its magnitude? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.7419 attainment
- B. 0.6800 attainment
- C. 0.7647 attainment
- D. 0.7143 attainment

6. An arithmetic sequence begins at 5 and increases by 3. What is its 12th term? With reference 2, compute $\text{attainment}=|\text{raw result}|/(r+|\text{raw result}|)$. What bounded attainment score results?

- A. 0.9562 attainment
- B. 0.9500 attainment
- C. 0.9417 attainment
- D. 0.9611 attainment

7. What is the volume of a cylinder with radius 2 m and height 5 m, using $\pi=3.1416$? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.9544 attainment
- B. 0.9601 attainment
- C. 0.9468 attainment
- D. 0.9646 attainment

8. A 24 V source is applied across an 8 Ω resistor. What current flows? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.5000 attainment
- B. 0.3333 attainment
- C. 0.4286 attainment
- D. 0.5556 attainment

9. A 10 kg cart travels at 4 m/s. What is its kinetic energy? The reporting scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.9485 attainment
- B. 0.9412 attainment
- C. 0.9315 attainment
- D. 0.9541 attainment

10. A 30 kN axial load acts on a 600 mm² section. What is the normal stress? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.9055 attainment
- B. 0.8763 attainment
- C. 0.9155 attainment
- D. 0.8929 attainment

11. Water flows at 2.5 m/s through a 0.08 m² section. What is the volumetric flow rate? With reference 2, compute $\text{attainment}=|\text{raw result}|/(r+|\text{raw result}|)$. What bounded attainment score results?

- A. 0.3750 attainment
- B. 0.2857 attainment
- C. 0.0909 attainment
- D. 0.5238 attainment

12. An engineer receives credible evidence that test data were intentionally altered before regulatory submission. What should the engineer do?

- A. Approve the submission because management authorized it
- B. Preserve evidence, report properly, and refuse to endorse altered data
- C. Delete the original data to prevent confusion
- D. Discuss the alteration only after regulatory approval

13. A design team plans to use software output without confirming the model assumptions. What should the responsible engineer require?

- A. Verify assumptions, inputs, limitations, and results before relying on the output
- B. Accept the output because commercial software is validated
- C. Review only the appearance of generated graphs
- D. Assume default settings match every project condition

14. A community representative asks an engineer to explain a project risk in understandable terms. What is the best response?

- A. Use unexplained jargon to discourage further questions
- B. State that every engineering risk is mathematically impossible
- C. Discuss benefits while withholding known consequences
- D. Provide a clear, accurate explanation of likelihood, consequences, uncertainty, and controls

15. An engineer identifies a personal relationship with an employee of a bidding contractor. What should happen?

- A. Conceal it because no money has changed hands
- B. Give the contractor informal access to competing bids
- C. Score the contractor first before disclosing anything
- D. Disclose the relationship and follow the organization's impartiality and recusal process

16. An investment of \$5,000 earns 6% annually for 3 years. What is its future value? With reference 2, compute attainment= $|raw\ result|/(r+|raw\ result|)$. What bounded attainment score results?

- A. 0.9297 attainment
- B. 0.9997 attainment
- C. 0.9996 attainment
- D. 0.7897 attainment

17. What is the present worth of \$10,000 received 4 years from now at 5% annual interest? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.9996 attainment
- B. 0.9296 attainment
- C. 0.9997 attainment
- D. 0.7896 attainment

18. A product sells for \$50, variable cost is \$30, and fixed cost is \$40,000. What is break-even volume? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.9983 attainment
- B. 0.9977 attainment
- C. 0.9980 attainment
- D. 0.9985 attainment

19. Equipment costs \$72,000, has \$12,000 salvage value, and a 5-year life. What is annual straight-line depreciation? The reporting scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.9296 attainment
- B. 0.9995 attainment
- C. 0.9997 attainment
- D. 0.9996 attainment

20. A \$90,000 project returns \$18,000 per year. Ignoring interest, what is its simple payback period? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.5000 attainment
- B. 0.4000 attainment
- C. 0.4545 attainment
- D. 0.5385 attainment

21. Annual fixed cost is \$24,000 and output is 8,000 units. What fixed cost is allocated per unit? With reference 2, compute $\text{attainment}=|\text{raw result}|/(r+|\text{raw result}|)$. What bounded attainment score results?

- A. 0.6000 attainment
- B. 0.6667 attainment
- C. 0.5000 attainment
- D. 0.7143 attainment

22. A machine saves \$15,000 annually but costs \$60,000. What is the simple annual return percentage? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.9055 attainment
- B. 0.8929 attainment
- C. 0.8763 attainment

D. 0.9155 attainment

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 ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

A. 0.3750 attainment

B. 0.2593 attainment

C. 0.0909 attainment

D. 0.4595 attainment

24. An item costs \$80 after a 20% price reduction. What was its original price? The reporting scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

A. 0.9524 attainment

B. 0.9583 attainment

C. 0.9444 attainment

D. 0.9630 attainment

25. A replacement reduces annual operating cost from \$48,000 to \$33,000. What is the annual savings? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

A. 0.9997 attainment

B. 0.9995 attainment

C. 0.7896 attainment

D. 0.9996 attainment

26. A fair coin is tossed 4 times. What is the probability of exactly 2 heads? With reference 2, compute $\text{attainment}=|\text{raw result}|/(r+|\text{raw result}|)$. What bounded attainment score results?

A. 0.4074 attainment

- B. 0.2381 attainment
- C. 0.1579 attainment
- D. 0.5429 attainment

27. A distribution has values 4, 7, 9, and 12. What is the arithmetic mean? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.7541 attainment
- B. 0.7273 attainment
- C. 0.6939 attainment
- D. 0.7761 attainment

28. A normal observation is 70 with mean 58 and standard deviation 6. What is its z-score? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.4286 attainment
- B. 0.2000 attainment
- C. 0.3333 attainment
- D. 0.5000 attainment

29. Independent events have probabilities 0.30 and 0.40. What is the probability both occur? The reporting scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.0234 attainment
- B. 0.1830 attainment
- C. 0.1497 attainment
- D. 0.2978 attainment

30. A defect rate is 0.02. In 200 independent items, what is the expected number defective? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.4545 attainment
- B. 0.3333 attainment
- C. 0.5000 attainment
- D. 0.4000 attainment

31. For data 2, 5, 8, 11, what is the population variance? With reference 2, compute attainment= $|raw\ result|/(r+|raw\ result|)$. What bounded attainment score results?

- A. 0.8661 attainment
- B. 0.8270 attainment
- C. 0.8797 attainment
- D. 0.8491 attainment

32. A sample mean is 40, population σ is 8, and $n=64$. What is the standard error? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.4000 attainment
- B. 0.0000 attainment
- C. 0.2500 attainment
- D. 0.5000 attainment

33. A regression model is $y=12+3x$. What value is predicted when $x=7$? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.9046 attainment
- B. 0.8919 attainment
- C. 0.8752 attainment
- D. 0.9147 attainment

34. How many distinct pairs can be selected from 10 items? The reporting scale uses $magnitude/(reference+magnitude)$, where reference=5. What bounded score is obtained?

- A. 0.9000 attainment
- B. 0.9119 attainment
- C. 0.8844 attainment
- D. 0.9213 attainment

35. Events A and B are mutually exclusive with probabilities 0.25 and 0.35. What is $P(A \text{ or } B)$? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.0909 attainment
- B. 0.2105 attainment
- C. 0.0625 attainment
- D. 0.3023 attainment

36. A process mean is estimated from four sample means: 19, 21, 20, and 24. What is the grand mean? With reference 2, compute $\text{attainment} = |\text{raw result}|/(r+|\text{raw result}|)$. What bounded attainment score results?

- A. 0.9235 attainment
- B. 0.9130 attainment
- C. 0.8992 attainment
- D. 0.9317 attainment

37. A linear objective is $Z=8x+5y$. What is Z at $x=6$ and $y=4$? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.9631 attainment
- B. 0.9507 attainment
- C. 0.9672 attainment
- D. 0.9577 attainment

38. A single-server system has arrival rate 6 per hour and service rate 10 per hour. What is utilization? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.2857 attainment
- B. 0.0909 attainment
- C. 0.1304 attainment
- D. 0.3939 attainment

39. A payoff is \$100 with probability 0.7 and \$20 with probability 0.3. What is expected payoff? The reporting scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.9459 attainment
- B. 0.9282 attainment
- C. 0.9383 attainment
- D. 0.9518 attainment

40. A simulation uses $u=0.64$ with exponential mean 5. Using $x=-5 \ln(1-u)$, what variate results? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.3899 attainment
- B. 0.5045 attainment
- C. 0.4064 attainment
- D. 0.4599 attainment

41. For constraint $3x+2y \leq 30$, how much slack exists at $x=4$ and $y=6$? With reference 2, compute $\text{attainment}=|\text{raw result}|/(r+|\text{raw result}|)$. What bounded attainment score results?

- A. 0.7778 attainment
- B. 0.7500 attainment
- C. 0.7143 attainment
- D. 0.8000 attainment

42. A Markov state has outgoing probabilities 0.55, 0.25, and p . What is p ? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.0625 attainment
- B. 0.2857 attainment
- C. 0.2105 attainment
- D. 0.4231 attainment

43. A database query returns 240 rows from 1,200 records. What percentage is returned? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.8519 attainment
- B. 0.8095 attainment
- C. 0.8333 attainment
- D. 0.8667 attainment

44. An algorithm performs 12 comparisons for each of 75 records. How many comparisons occur? The reporting scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.9945 attainment
- B. 0.9952 attainment
- C. 0.9935 attainment
- D. 0.9957 attainment

45. A weighted score uses weights 0.4, 0.35, 0.25 and ratings 80, 70, 90. What is the score? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.9380 attainment
- B. 0.9294 attainment

- C. 0.9180 attainment
- D. 0.9448 attainment

46. A model predicts 105 and the observed value is 98. What is the absolute error? With reference 2, compute attainment= $|raw\ result|/(r+|raw\ result|)$. What bounded attainment score results?

- A. 0.8010 attainment
- B. 0.7484 attainment
- C. 0.8198 attainment
- D. 0.7778 attainment

47. A project path contains activities of 3, 7, 4, and 6 days. What is the path duration? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.8846 attainment
- B. 0.8500 attainment
- C. 0.8696 attainment
- D. 0.8966 attainment

48. Planned value is \$80,000 and earned value is \$72,000. What is schedule variance? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.9995 attainment
- B. 0.9994 attainment
- C. 0.9996 attainment
- D. 0.9993 attainment

49. Earned value is \$90,000 and actual cost is \$100,000. What is cost performance index? The reporting scale uses magnitude/(reference+magnitude), where reference=5. What bounded score is obtained?

- A. 0.2754 attainment
- B. 0.1525 attainment
- C. 0.0196 attainment
- D. 0.3671 attainment

50. A team produces 360 units in 45 labor-hours. What is labor productivity? Calculate the saturation score $|quantity|/(6+|quantity|)$. What value should appear on the dashboard?

- A. 0.6053 attainment
- B. 0.5714 attainment
- C. 0.5312 attainment
- D. 0.6341 attainment

51. PERT estimates are optimistic 4, most likely 7, and pessimistic 16 days. What is expected duration? With reference 2, compute attainment= $|raw\ result|/(r+|raw\ result|)$. What bounded attainment score results?

- A. 0.8214 attainment
- B. 0.7727 attainment
- C. 0.8387 attainment
- D. 0.8000 attainment

52. A project has budget at completion \$250,000 and CPI 0.80. What is the basic estimate at completion? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

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

53. A decision yields \$60,000 with probability 0.6 and loses \$10,000 with probability 0.4. What is expected value? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

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

54. A department completes 950 conforming orders from 1,000 total. What is its conformance KPI? The reporting scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.9562 attainment
- B. 0.9417 attainment
- C. 0.9611 attainment
- D. 0.9500 attainment

55. A task has latest start day 18 and earliest start day 14. What is total slack? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.4000 attainment
- B. 0.4545 attainment
- C. 0.3333 attainment
- D. 0.5000 attainment

56. A line makes 480 units during an 8-hour shift. What is average throughput? With reference 2, compute $\text{attainment}=|\text{raw result}|/(r+|\text{raw result}|)$. What bounded attainment score results?

- A. 0.9718 attainment
- B. 0.9677 attainment
- C. 0.9623 attainment

D. 0.9750 attainment

57. A station has 45 minutes of work content and a 9-minute cycle time. What is the theoretical minimum number of stations? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

A. 0.6667 attainment

B. 0.5714 attainment

C. 0.6250 attainment

D. 0.7000 attainment

58. Demand is 1,600 units/year, order cost is \$25, and holding cost is \$2/unit-year. What is EOQ? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

A. 0.9829 attainment

B. 0.9770 attainment

C. 0.9848 attainment

D. 0.9804 attainment

59. Forecasts use $\alpha=0.30$, prior forecast 100, and actual demand 120. What is the new exponential-smoothing forecast? The reporting scale uses magnitude/(reference+magnitude), where reference=5. What bounded score is obtained?

A. 0.9606 attainment

B. 0.9550 attainment

C. 0.9474 attainment

D. 0.9650 attainment

60. What is the three-period moving average of demands 90, 105, and 120? Calculate the saturation score $|quantity|/(6+|quantity|)$. What value should appear on the dashboard?

- A. 0.9527 attainment
- B. 0.9370 attainment
- C. 0.9459 attainment
- D. 0.9579 attainment

61. A machine operates 420 minutes of a planned 480 minutes. What is availability? With reference 2, compute attainment= $| \text{raw result} | / (r + | \text{raw result} |)$. What bounded attainment score results?

- A. 0.9805 attainment
- B. 0.9738 attainment
- C. 0.9827 attainment
- D. 0.9777 attainment

62. A process has availability 0.90, performance 0.95, and quality 0.98. What is OEE? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.9654 attainment
- B. 0.9698 attainment
- C. 0.9596 attainment
- D. 0.9732 attainment

63. A batch of 500 pieces includes 15 defective pieces. What is first-pass yield? Transform the ordinary answer using $|x| / (4 + |x|)$. What dimensionless attainment value is reported?

- A. 0.9654 attainment
- B. 0.9537 attainment
- C. 0.9604 attainment
- D. 0.9693 attainment

64. Setup is reduced from 50 minutes to 35 minutes. What is the reduction percentage? The reporting scale uses $\text{magnitude} / (\text{reference} + \text{magnitude})$, where reference=5. What bounded score is obtained?

- A. 0.8734 attainment
- B. 0.8571 attainment
- C. 0.8361 attainment
- D. 0.8864 attainment

65. A bottleneck produces one unit every 6 minutes. What is its hourly capacity? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.6250 attainment
- B. 0.6571 attainment
- C. 0.5862 attainment
- D. 0.6842 attainment

66. A department moves 30 loads over 12 m. What is its load-distance contribution? With reference 2, compute attainment= $|\text{raw result}|/(r+|\text{raw result}|)$. What bounded attainment score results?

- A. 0.9952 attainment
- B. 0.9935 attainment
- C. 0.9957 attainment
- D. 0.9945 attainment

67. Demand is 240 units/day and one machine makes 60 units/day. Ignoring downtime, how many machines are required? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.6250 attainment
- B. 0.5000 attainment
- C. 0.5714 attainment
- D. 0.6667 attainment

68. Average demand is 50 units/day and lead time is 6 days. With no safety stock, what is reorder point? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.9885 attainment
- B. 0.9868 attainment
- C. 0.9846 attainment
- D. 0.9898 attainment

69. A warehouse ships 1,800 lines in 30 labor-hours. What is picking productivity? The reporting scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.9324 attainment
- B. 0.9107 attainment
- C. 0.9398 attainment
- D. 0.9231 attainment

70. Annual demand is 12,000 units and average inventory is 1,500 units. What is inventory turnover? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.5714 attainment
- B. 0.6053 attainment
- C. 0.5312 attainment
- D. 0.6341 attainment

71. Three candidate location coordinates have equal weights: (2,4), (8,7), and (5,10). What is the x-coordinate of the center of gravity? With reference 2, compute $\text{attainment}=|\text{raw result}|/(r+|\text{raw result}|)$. What bounded attainment score results?

- A. 0.7143 attainment
- B. 0.7500 attainment
- C. 0.6667 attainment
- D. 0.7778 attainment

72. A truck carries 18 pallets per trip. How many pallets are moved in 14 full trips? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.9898 attainment
- B. 0.9862 attainment
- C. 0.9909 attainment
- D. 0.9882 attainment

73. Supplier lead times are 4, 6, 5, and 9 days. What is the average lead time? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.6364 attainment
- B. 0.5556 attainment
- C. 0.6000 attainment
- D. 0.6667 attainment

74. A facility uses 72,000 ft² of its 90,000 ft² available area. What is space utilization? The reporting scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.9485 attainment
- B. 0.9412 attainment
- C. 0.9315 attainment
- D. 0.9541 attainment

75. A shipment of 2,400 kg is split equally among 6 destinations. What mass goes to each? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.9852 attainment
- B. 0.9871 attainment

- C. 0.9827 attainment
- D. 0.9886 attainment

76. A task cycle is 50 seconds, including 8 seconds of unavoidable delay. What percentage is delay? With reference 2, compute attainment= $|raw\ result|/(r+|raw\ result|)$. What bounded attainment score results?

- A. 0.9020 attainment
- B. 0.8718 attainment
- C. 0.9123 attainment
- D. 0.8889 attainment

77. A display has 96 correct readings in 120 trials. What is reading accuracy? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.9684 attainment
- B. 0.9577 attainment
- C. 0.9639 attainment
- D. 0.9720 attainment

78. A worker exerts 180 N at a perpendicular moment arm of 0.40 m. What joint moment results? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.9474 attainment
- B. 0.9539 attainment
- C. 0.9387 attainment
- D. 0.9590 attainment

79. A population measurement has mean 170 cm and standard deviation 8 cm. What value is two standard deviations above the mean? The reporting scale uses magnitude/(reference+magnitude), where reference=5. What bounded score is obtained?

- A. 0.9772 attainment
- B. 0.9738 attainment
- C. 0.9693 attainment
- D. 0.9797 attainment

80. An operator reacts in 0.75 s while a conveyor moves 1.6 m/s. How far does the belt travel? Calculate the saturation score $|quantity|/(6+|quantity|)$. What value should appear on the dashboard?

- A. 0.2683 attainment
- B. 0.0323 attainment
- C. 0.1667 attainment
- D. 0.3478 attainment

81. A workstation redesign reduces reaches from 250 to 175 per shift. What is the reduction percentage? With reference 2, compute $attainment = |raw\ result|/(r+|raw\ result|)$. What bounded attainment score results?

- A. 0.9452 attainment
- B. 0.9375 attainment
- C. 0.9273 attainment
- D. 0.9512 attainment

82. A safety program records 6 incidents over 300,000 exposure-hours. What is the rate per 200,000 hours? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.6250 attainment
- B. 0.5000 attainment
- C. 0.6667 attainment
- D. 0.5714 attainment

83. A control requires 18 N force and has a 0.06 m lever arm. What operating torque is required? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.2126 attainment
- B. 0.3421 attainment
- C. 0.0196 attainment
- D. 0.4350 attainment

84. A team completes 45 safe observations out of 50 observations. What percentage is safe? The reporting scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.9539 attainment
- B. 0.9474 attainment
- C. 0.9387 attainment
- D. 0.9590 attainment

85. Observed task time is 8.0 minutes and performance rating is 110%. What is normal time? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.6278 attainment
- B. 0.5549 attainment
- C. 0.5946 attainment
- D. 0.6560 attainment

86. Normal time is 12 minutes and allowance is 20% of normal time. What is standard time? With reference 2, compute $\text{attainment}=|\text{raw result}|/(r+|\text{raw result}|)$. What bounded attainment score results?

- A. 0.8922 attainment
- B. 0.8596 attainment
- C. 0.9035 attainment
- D. 0.8780 attainment

87. Work sampling finds 315 working observations among 420 observations. What is utilization? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.9664 attainment
- B. 0.9615 attainment
- C. 0.9551 attainment
- D. 0.9701 attainment

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 ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.8214 attainment
- B. 0.7727 attainment
- C. 0.8387 attainment
- D. 0.8000 attainment

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 scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.5455 attainment
- B. 0.5833 attainment
- C. 0.5000 attainment
- D. 0.6154 attainment

90. A worker produces 72 units during 6 productive hours. What is observed production rate? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.6970 attainment

- B. 0.6296 attainment
- C. 0.6667 attainment
- D. 0.7222 attainment

91. A standard permits 9 minutes per unit. How many units fit in 450 available minutes? With reference 2, compute attainment= $| \text{raw result} | / (r + | \text{raw result} |)$. What bounded attainment score results?

- A. 0.9664 attainment
- B. 0.9615 attainment
- C. 0.9551 attainment
- D. 0.9701 attainment

92. A method improvement reduces cycle time from 15 minutes to 12 minutes. What is the improvement percentage? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.8696 attainment
- B. 0.8846 attainment
- C. 0.8500 attainment
- D. 0.8966 attainment

93. Specification limits are 52 and 40, and process $\sigma=2$. What is C_p ? Transform the ordinary answer using $|x| / (4 + |x|)$. What dimensionless attainment value is reported?

- A. 0.3333 attainment
- B. 0.0000 attainment
- C. 0.2000 attainment
- D. 0.4286 attainment

94. $USL=110$, $\text{mean}=100$, and $\sigma=4$. What is the upper capability component? The reporting scale uses $\text{magnitude} / (\text{reference} + \text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.0729 attainment
- B. 0.2683 attainment
- C. 0.0323 attainment
- D. 0.1429 attainment

95. A p-chart has $\bar{p}=0.04$ and $n=400$. What is the three-sigma upper control limit? Calculate the saturation score $|quantity|/(6+|quantity|)$. What value should appear on the dashboard?

- A. 0.0814 attainment
- B. 0.1513 attainment
- C. 0.1343 attainment
- D. 0.0114 attainment

96. A sample has defect counts 3, 5, 4, and 8. What is the average count? With reference 2, compute $attainment=|raw\ result|/(r+|raw\ result|)$. What bounded attainment score results?

- A. 0.7500 attainment
- B. 0.6667 attainment
- C. 0.7143 attainment
- D. 0.7778 attainment

97. A Taguchi loss constant is 4 and deviation from target is 3. What is the quality loss? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.9231 attainment
- B. 0.9324 attainment
- C. 0.9107 attainment
- D. 0.9398 attainment

98. A process yields 970 conforming units out of 1,000. What is percent defective? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.5000 attainment
- B. 0.4286 attainment
- C. 0.3333 attainment
- D. 0.5556 attainment

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 scale uses $\text{magnitude}/(\text{reference}+\text{magnitude})$, where $\text{reference}=5$. What bounded score is obtained?

- A. 0.8453 attainment
- B. 0.8627 attainment
- C. 0.8228 attainment
- D. 0.8766 attainment

100. A lot has 12 defects in 600 opportunities. What is defects per million opportunities? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.9297 attainment
- B. 0.9996 attainment
- C. 0.9997 attainment
- D. 0.9998 attainment

101. A process improves yield from 88% to 94%. What is the percentage-point increase? With reference 2, compute $\text{attainment}=|\text{raw result}|/(r+|\text{raw result}|)$. What bounded attainment score results?

- A. 0.7778 attainment
- B. 0.7500 attainment
- C. 0.7143 attainment
- D. 0.8000 attainment

102. Two independent series components have reliabilities 0.95 and 0.90. What is system reliability? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

- A. 0.3821 attainment
- B. 0.0461 attainment
- C. 0.4876 attainment
- D. 0.2218 attainment

103. Two independent parallel components each have reliability 0.80. What is system reliability? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

- A. 0.3289 attainment
- B. 0.1935 attainment
- C. 0.0099 attainment
- D. 0.4253 attainment

104. A repairable system has MTBF 900 h and MTTR 100 h. What is inherent availability? The reporting scale uses $\text{magnitude}/(\text{reference} + \text{magnitude})$, where $\text{reference} = 5$. What bounded score is obtained?

- A. 0.2754 attainment
- B. 0.0196 attainment
- C. 0.1525 attainment
- D. 0.3671 attainment

105. An FMEA item has severity 8, occurrence 5, and detection 4. What is its RPN? Calculate the saturation score $|\text{quantity}|/(6+|\text{quantity}|)$. What value should appear on the dashboard?

- A. 0.9684 attainment
- B. 0.9577 attainment
- C. 0.9720 attainment

D. 0.9639 attainment

106. A system operates 1,920 h and is down 80 h. What is observed availability? With reference 2, compute attainment= $|raw\ result|/(r+|raw\ result|)$. What bounded attainment score results?

A. 0.9796 attainment

B. 0.9822 attainment

C. 0.9761 attainment

D. 0.9842 attainment

107. Three series elements each have reliability 0.98. What is total reliability? A performance index equals absolute raw value divided by reference plus absolute raw value, using reference 3. What index results?

A. 0.1688 attainment

B. 0.3929 attainment

C. 0.2388 attainment

D. 0.0192 attainment

108. A requirement set contains 240 requirements, of which 228 pass verification. What is verification completion? Transform the ordinary answer using $|x|/(4+|x|)$. What dimensionless attainment value is reported?

A. 0.9647 attainment

B. 0.9528 attainment

C. 0.9686 attainment

D. 0.9596 attainment

109. A component accumulates 12 failures over 6,000 operating hours. What is failure rate per 1,000 hours? The reporting scale uses $magnitude/(reference+magnitude)$, where reference=5. What bounded score is obtained?

- A. 0.2857 attainment
- B. 0.3750 attainment
- C. 0.1667 attainment
- D. 0.4444 attainment

110. A life-cycle alternative costs \$120,000 initially and \$18,000 annually for 5 years, ignoring discounting. What is total life-cycle cost? Calculate the saturation score $|quantity|/(6+|quantity|)$. What value should appear on the dashboard?

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

Practice Exam 7: Answer Key and Explanations

1. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.9844. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

2. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.9189. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

3. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.8571. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

4. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.8571. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

5. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.7143.

The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

6. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.9500. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

7. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.9544. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

8. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.4286. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

9. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9412. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

10. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.8929. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

11. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.0909. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

12. B — B is correct. Intentional alteration of material test data threatens accurate oversight, requiring preservation, escalation, and refusal to authenticate misleading information. The alternatives conceal evidence, substitute software confidence for review, obscure risk, or permit biased evaluation. Applying duties of honesty, competence, communication, and objectivity identifies the response that provides a record and supports decisions based on verified information.

13. A — A is correct. Professional judgment includes understanding software assumptions and checking whether inputs, limitations, and results are appropriate for the specific application. The alternatives conceal evidence, substitute software confidence for review, obscure risk, or permit biased evaluation. Applying duties of honesty, competence, communication, and objectivity identifies the response that provides a record and supports decisions based on verified information.

14. D — D is correct. Risk communication should be accurate and understandable, including uncertainty and controls, so affected people can make informed judgments. The alternatives conceal evidence, substitute software confidence for review, obscure risk, or permit biased evaluation. Applying duties of honesty, competence, communication, and objectivity identifies the response that provides a record and supports decisions based on verified information.

15. D — D is correct. A personal relationship can create an appearance of bias, making disclosure and an established impartiality process necessary for credible evaluation. The alternatives conceal evidence, substitute software confidence for review, obscure risk, or permit biased evaluation. Applying duties of honesty, competence, communication, and objectivity identifies the response that provides a record and supports decisions based on verified information.

16. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.9997. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

17. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.9996. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

18. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.9980. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

19. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9996. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

20. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.4545. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

21. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.6000. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

22. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.8929.

The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

23. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.2593. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

24. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9524. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

25. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.9996. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

26. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.1579. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

27. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.7273. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

28. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.3333. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

29. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.0234. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

30. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.4000. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

31. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.8491.

The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

32. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.2500. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

33. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.8919. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

34. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9000. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

35. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.0909. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

36. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.9130. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

37. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.9577. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

38. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.1304. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

39. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9383. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

40. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.4599.

The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

41. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.7500. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

42. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.0625. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

43. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.8333. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

44. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9945. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

45. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.9294. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

46. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.7778. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

47. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.8696. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

48. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.9995. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

49. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.1525.

The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

50. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.5714. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

51. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.8000. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

52. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 1.0000. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

53. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.9999. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

54. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9500. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

55. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.4000. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

56. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.9677. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

57. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.6250. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

58. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.9804.

The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

59. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9550. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

60. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.9459. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

61. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.9777. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

62. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.9654. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

63. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.9604. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

64. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.8571. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

65. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.6250. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

66. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.9945. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

67. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.5714.

The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

68. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.9868. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

69. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9231. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

70. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.5714. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

71. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.7143. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

72. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.9882. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

73. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.6000. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

74. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9412. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

75. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.9852. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

76. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.8889.

The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

77. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.9639. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

78. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.9474. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

79. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9738. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

80. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.1667. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

81. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.9375. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

82. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.5714. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

83. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.2126. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

84. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.9474. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

85. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.5946.

The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

86. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.8780. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

87. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.9615. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

88. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.8000. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

89. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.5455. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

90. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.6667. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

91. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.9615. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

92. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.8696. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

93. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.2000. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

94. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.1429.

The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

95. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.0114. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

96. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.7143. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

97. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.9231. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

98. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.4286. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

99. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.8453. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

100. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.9997. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

101. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.7500. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

102. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.2218. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

103. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is

0.1935. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

104. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.1525. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

105. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 0.9639. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

106. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 2 and the magnitude. The bounded attainment score is 0.9796. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

107. C — C is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 3 and the magnitude. The bounded attainment score is 0.2388. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

108. D — D is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 4 and the magnitude. The bounded attainment score is 0.9596. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

109. A — A is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 5 and the magnitude. The bounded attainment score is 0.2857. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.

110. B — B is correct. Solve the underlying engineering quantity, take its absolute magnitude, and divide that magnitude by the sum of reference 6 and the magnitude. The bounded attainment score is 1.0000. The other options result from using an incorrect raw answer, reversing numerator and reference, or omitting a term from the denominator.