PRACTICE EXAM 14: CTS-I SIMULATION

QUESTIONS 1–125

Domain A — Conducting Pre-Installation Activities

1. A 1-inch EMT conduit has an internal cross-sectional area of 0.864 square inches. The maximum cable area permitted at 40% fill is:

A. 0.432 square inches

B. 0.286 square inches

C. 0.346 square inches

D. 0.520 square inches

2. A 2-inch EMT conduit has an internal cross-sectional area of 3.36 square inches. The maximum cable area permitted at 40% fill is:

A. 1.344 square inches

B. 1.120 square inches

C. 1.568 square inches

D. 1.680 square inches

3. An installer plans 20 cable runs averaging 80 feet. Including 4-foot rack service loops and 4-foot device service loops on each run, the base cable length is:

A. 1,600 feet

B. 1,680 feet

C. 1,720 feet

D. 1,760 feet

4. Continuing from the previous question, adding 15% contingency to the 1,760-foot base yields total order length of approximately:

A. 1,936 feet

B. 2,024 feet

C. 2,112 feet

D. 2,200 feet

5. A 0.30-inch diameter cable has cross-sectional area of approximately:

A. 0.0707 square inches

B. 0.0472 square inches

C. 0.0943 square inches

D. 0.0236 square inches

6. A conduit with 1.496 square inch internal area contains 8 cables at 0.075 square inch each. The fill percentage is:

A. 35.2%

B. 38.4%

C. 40.1%

D. 42.3%

7. A wiring schedule lists 180 cable runs requiring labels at both ends. Total labels required:

A. 180 labels

B. 240 labels

C. 300 labels

D. 360 labels

8. A drawing scale of 1/4" = 1'-0" shows a wall 8 inches long on the drawing. The actual dimension is:

A. 24 feet

B. 32 feet

C. 16 feet

D. 40 feet

9. A project requires 220 cable ties, 110 velcro straps, and 440 labels. Current inventory shows 80 cable ties, 40 velcro straps, and 200 labels. The procurement gap is:

A. Cable ties: 140, Velcro: 70, Labels: 240

B. Cable ties: 120, Velcro: 60, Labels: 220

C. Cable ties: 140, Velcro: 60, Labels: 220

D. Cable ties: 120, Velcro: 70, Labels: 240

10. A 2.5-inch EMT conduit has internal cross-sectional area of approximately 4.93 square inches. Maximum cable area at 40% fill is:

A. 1.865 square inches

B. 1.950 square inches

C. 1.972 square inches

D. 2.100 square inches

11. A labor estimate includes 100 baseline hours. Applied productivity factors are 20% increase for occupied building and 10% increase for restricted access. Total estimated hours using multiplicative factors:

A. 130 hours

B. 132 hours

C. 134 hours

D. 140 hours

12. A display weighs 95 pounds. Required mount/wall capacity at 4:1 safety factor is:

A. 285 pounds

B. 320 pounds

C. 350 pounds

D. 380 pounds

13. A cable pull passes through 4 bends of 90 degrees each. Cumulative bend angle is:

A. 180 degrees

B. 270 degrees

C. 360 degrees

D. 450 degrees

14. A conduit fill percentage of 45% for three or more cables indicates:

A. Exceeds the NEC 40% limit and requires pathway redesign

B. Meets the NEC 40% limit for three or more cables

C. Is below the NEC 31% limit for two cables

D. Complies with the NEC 53% limit for single cables

15. A 0.24-inch diameter cable has cross-sectional area of approximately:

A. 0.0283 square inches

B. 0.0378 square inches

C. 0.0424 square inches

D. 0.0452 square inches

16. A take-off calculation shows 1,200 feet of cable with 12% contingency. Order length is:

A. 1,320 feet

B. 1,344 feet

C. 1,368 feet

D. 1,392 feet

17. A drawing scale of 1/8" = 1'-0" shows a room 10 inches wide on paper. The actual dimension is:

A. 80 feet

B. 64 feet

C. 56 feet

D. 72 feet

18. A 12U rack space at 1.75 inches per RU occupies:

A. 18 inches

B. 20 inches

C. 21 inches

D. 24 inches

19. A 175-pound display mounted at 4:1 safety factor requires mount/wall capacity of:

A. 600 pounds

B. 700 pounds

C. 750 pounds

D. 800 pounds

20. A project's 3-inch EMT conduit has internal cross-sectional area of approximately 7.38 square inches. Maximum cable area at 40% fill:

A. 2.625 square inches

B. 2.700 square inches

C. 2.850 square inches

D. 2.952 square inches

21. A cable run of 68 feet with a 5-foot service loop at each end requires base length of:

A. 78 feet

B. 80 feet

C. 82 feet

D. 85 feet

22. The 80% rule applied to a 15-ampere circuit limits continuous loads to:

A. 10 amperes

B. 11 amperes

C. 12 amperes

D. 13 amperes

23. A 1.25-inch EMT conduit has internal cross-sectional area of approximately 1.496 square inches. Maximum cable area at 40% fill is:

A. 0.526 square inches

B. 0.598 square inches

C. 0.620 square inches

D. 0.690 square inches

24. An installer calculates 150 base labor hours. With 25% increase for evening shifts only, total hours are:

A. 165 hours

B. 175 hours

C. 180 hours

D. 187.5 hours

25. A drawing scale of 1/2" = 1'-0" shows a distance of 6 inches on paper. The actual dimension is:

A. 8 feet

B. 10 feet

C. 12 feet

D. 14 feet

26. A 16U rack-mount device requires vertical space of:

A. 26 inches

B. 28 inches

C. 30 inches

D. 32 inches

27. A 0.40-inch diameter cable has cross-sectional area of approximately:

A. 0.0754 square inches

B. 0.1005 square inches

C. 0.1178 square inches

D. 0.1257 square inches

28. An OSHA 30-hour construction safety card is primarily required for:

A. Supervisory personnel and competent persons on construction sites

B. General workers on residential projects

C. Security personnel at construction sites

D. Delivery drivers accessing construction sites

Domain B — Conducting Site Rough-In/First-Fix

29. A cable pull through conduit with cumulative bend angle of 450 degrees between pull points:

A. Meets NEC requirements

B. Is at the NEC limit

C. Exceeds NEC 360-degree limit and requires intermediate pull point

D. Is below the NEC 270-degree limit

30. A 3/8-inch A307 threaded rod has tensile failure capacity of approximately 5,700 pounds. Working load at 4:1 non-overhead safety factor is:

A. 1,140 pounds

B. 1,425 pounds

C. 2,280 pounds

D. 1,900 pounds

31. Continuing from the previous question, the same rod applied to overhead loading at 5:1 safety factor has working load of:

A. 950 pounds

B. 1,050 pounds

C. 1,100 pounds

D. 1,140 pounds

32. An extension ladder at 4-to-1 rule with base 5 feet from structure has working height of approximately:

A. 20 feet

B. 18 feet

C. 22 feet

D. 24 feet

33. An OSHA fall protection anchor point requires capacity of 5,000 pounds per worker. For 2 workers simultaneously attached, capacity required is:

A. 5,000 pounds

B. 7,500 pounds

C. 10,000 pounds

D. 12,500 pounds

34. A cable pull with 3 bends of 90 degrees and 1 bend of 45 degrees has cumulative bend angle of:

A. 270 degrees

B. 315 degrees

C. 360 degrees

D. 405 degrees

35. A cable with manufacturer-specified minimum bend radius of 4× diameter for a 0.35-inch cable has minimum bend radius of:

A. 0.35 inches

B. 0.70 inches

C. 1.05 inches

D. 1.40 inches

36. A 1/2-inch A307 threaded rod has tensile failure capacity of approximately 10,000 pounds. Working load at 4:1 non-overhead safety factor is:

A. 2,500 pounds

B. 3,000 pounds

C. 3,500 pounds

D. 4,000 pounds

37. A 1/4-inch A307 threaded rod has tensile failure capacity of approximately 2,500 pounds. Working load at 5:1 overhead safety factor is:

A. 400 pounds

B. 450 pounds

C. 500 pounds

D. 550 pounds

38. A cable pull requires 350 pounds of tension against a manufacturer maximum of 500 pounds. The margin to maximum is:

A. 30% margin

B. 35% margin

C. 40% margin

D. 50% margin

39. An extension ladder at 16 feet working height using 4-to-1 rule requires base:

A. 2 feet from structure

B. 3 feet from structure

C. 5 feet from structure

D. 4 feet from structure

40. A J-hook cable support with 5-foot spacing across a 50-foot cable run requires approximately:

A. 8 J-hooks

B. 9 J-hooks

C. 10 J-hooks

D. 11 J-hooks

41. A cable with minimum bend radius of 8× diameter installed in position for a 0.25-inch cable requires minimum bend radius of:

A. 2.0 inches

B. 2.5 inches

C. 3.0 inches

D. 3.5 inches

42. OSHA construction fall protection is required at:

A. 4 feet or greater

B. 6 feet or greater

C. 8 feet or greater

D. 10 feet or greater

Domain C — Installing Audiovisual Systems

43. A 42U rack frame provides vertical mounting height of:

A. 68 inches

B. 70 inches

C. 72 inches

D. 73.5 inches

44. A 25U rack device occupies:

A. 40 inches

B. 42 inches

C. 43.75 inches

D. 45 inches

45. The 80% rule applied to a 30-ampere circuit limits continuous loads to:

A. 24 amperes

B. 22 amperes

C. 25 amperes

D. 27 amperes

46. An amplifier dissipates 200 watts heat. Converting to BTU/hour uses factor 3.412, yielding approximately:

A. 650 BTU/hour

B. 682 BTU/hour

C. 700 BTU/hour

D. 720 BTU/hour

47. A 500-watt heat load converts to approximately:

A. 1,500 BTU/hour

B. 1,600 BTU/hour

C. 1,700 BTU/hour

D. 1,706 BTU/hour

48. A 70V amplifier rated at 600 watts should drive total tap loads of approximately:

A. 600 watts

B. 500 watts

C. 480 watts

D. 450 watts

49. A 70V system has 12 loudspeakers at 10-watt taps and 8 loudspeakers at 20-watt taps. Total tap load is:

A. 240 watts

B. 280 watts

C. 320 watts

D. 360 watts

50. A 70V amplifier rated at 350 watts should drive maximum tap load of approximately:

A. 280 watts

B. 300 watts

C. 320 watts

D. 350 watts

51. Three loudspeakers each at 4 ohms connected in parallel present combined impedance of:

A. 1.33 ohms

B. 4 ohms

C. 8 ohms

D. 12 ohms

52. Four loudspeakers each at 8 ohms connected in parallel present combined impedance of:

A. 4 ohms

B. 3 ohms

C. 2 ohms

D. 8 ohms

53. An 8-ohm loudspeaker with cable resistance limited to 5% of impedance has maximum cable resistance of:

A. 0.20 ohms

B. 0.40 ohms

C. 0.60 ohms

D. 0.80 ohms

54. A 4-ohm loudspeaker with cable resistance limited to 5% of impedance has maximum cable resistance of:

A. 0.10 ohms

B. 0.15 ohms

C. 0.18 ohms

D. 0.20 ohms

55. A 16-ohm loudspeaker with cable resistance limited to 5% of impedance has maximum cable resistance of:

A. 0.80 ohms

B. 0.40 ohms

C. 0.60 ohms

D. 1.00 ohm

56. Two 8-ohm loudspeakers in parallel present combined impedance of:

A. 16 ohms

B. 8 ohms

C. 4 ohms

D. 2 ohms

57. A 3 dB increase in audio power represents a power ratio of:

A. 4:1

B. 2:1

C. 3:1

D. 10:1

58. A 6 dB increase represents a power ratio of:

A. 2:1

B. 3:1

C. 5:1

D. 4:1

59. A 10 dB increase represents a power ratio of:

A. 10:1

B. 20:1

C. 5:1

D. 100:1

60. A 20 dB increase represents a power ratio of:

A. 10:1

B. 20:1

C. 100:1

D. 200:1

61. A 6 dB voltage increase represents a voltage ratio of:

A. 1.5:1

B. 2:1

C. 3:1

D. 4:1

62. A 1080p60 video signal at 8-bit color requires approximately:

A. 3.0 Gbps

B. 6.0 Gbps

C. 9.0 Gbps

D. 4.5 Gbps

63. A 4K60 video signal at 10-bit color with HDR requires approximately:

A. 24 Gbps

B. 18 Gbps

C. 12 Gbps

D. 36 Gbps

64. A 4K30 video signal at 8-bit color requires approximately:

A. 12 Gbps

B. 9 Gbps

C. 10.2 Gbps

D. 18 Gbps

65. Cat6A cable supports maximum frequency of:

A. 250 MHz

B. 500 MHz

C. 350 MHz

D. 1000 MHz

66. Cat6 cable supports maximum frequency of:

A. 500 MHz

B. 100 MHz

C. 350 MHz

D. 250 MHz

67. OM3 multimode fiber supports 10 Gbps Ethernet to:

A. 100 meters

B. 200 meters

C. 300 meters

D. 400 meters

68. OM4 multimode fiber supports 10 Gbps Ethernet to:

A. 400 meters

B. 300 meters

C. 200 meters

D. 100 meters

69. HDBaseT supports 4K60 over Cat6A to maximum distance of:

A. 50 meters

B. 75 meters

C. 200 meters

D. 100 meters

70. IEEE 802.3at (PoE+) provides power at powered device of:

A. 12.95 watts

B. 25.5 watts

C. 51 watts

D. 71 watts

71. IEEE 802.3af (basic PoE) provides power at powered device of:

A. 30 watts

B. 25.5 watts

C. 12.95 watts

D. 51 watts

72. IEEE 802.3bt Type 4 provides power at powered device of:

A. 71 watts

B. 51 watts

C. 25.5 watts

D. 90 watts

73. A /24 subnet provides usable host addresses of:

A. 256

B. 252

C. 128

D. 254

74. A /25 subnet provides usable host addresses of:

A. 128

B. 126

C. 254

D. 250

75. Dante typical latency at standard settings is:

A. 0.25 to 1 millisecond

B. 5 to 10 milliseconds

C. 10 to 20 milliseconds

D. 50 to 100 milliseconds

76. SDVoE distributes uncompressed 4K60 over network speed of:

A. 100 Mbps

B. 1 Gbps

C. 2.5 Gbps

D. 10 Gbps

77. A projector with throw ratio 2.2:1 at 22 feet distance produces image width of:

A. 10 feet

B. 12 feet

C. 14 feet

D. 16 feet

78. A projector with throw ratio 1.8:1 at 27 feet distance produces image width of:

A. 12 feet

B. 14 feet

C. 15 feet

D. 18 feet

79. A projector with throw ratio 2.0:1 at 30 feet distance produces image width of:

A. 12 feet

B. 15 feet

C. 20 feet

D. 25 feet

80. AVIXA DISCAS basic decision-making content maximum viewing distance is:

A. 4 times image height

B. 6 times image height

C. 12 times image height

D. 8 times image height

81. AVIXA DISCAS analytical decision-making content maximum viewing distance is:

A. 4 times image height

B. 6 times image height

C. 8 times image height

D. 12 times image height

82. The target gamma for standard video content is:

A. 1.8

B. 2.0

C. 2.2

D. 2.4

83. The target white point for video calibration is:

A. 5500K

B. 6500K (D65)

C. 7500K

D. 9300K

84. Phantom power for condenser microphones is standardized at:

A. 12 volts DC

B. 24 volts DC

C. 36 volts DC

D. 48 volts DC

85. The maximum permissible untwist at Cat6A termination is:

A. 0.5 inches

B. 0.75 inches

C. 0.25 inches

D. 1.0 inches

86. Professional amplifier sizing at 125% of tap load means a 400W amplifier drives maximum tap load of:

A. 400 watts

B. 280 watts

C. 320 watts

D. 500 watts

87. A 70V system with 20 loudspeakers at 5-watt taps and 10 loudspeakers at 15-watt taps has total tap load of:

A. 200 watts

B. 250 watts

C. 280 watts

D. 350 watts

88. A 70V amplifier at 1000 watts should drive maximum tap load of approximately:

A. 900 watts

B. 850 watts

C. 700 watts

D. 800 watts

Domain D — Perform Systems Close-Out

89. ANSI/AVIXA 10:2013 categorizes verification items into:

A. A-Level, B-Level, C-Level

B. Level 1, Level 2, Level 3

C. Primary, Secondary, Tertiary

D. Critical, Important, Optional

90. A punch list with 20 items classifies 8 as substantive and 12 as cosmetic. The substantive percentage is:

A. 30%

B. 35%

C. 40%

D. 45%

91. A 12-month warranty beginning at substantial completion on January 15 expires on:

A. January 14 following year

B. January 15 following year

C. February 15 following year

D. December 15 same year

92. A typical AV installation with 7-year service life reaching year 5 has remaining service life of approximately:

A. 4 years

B. 3 years

C. 2.5 years

D. 2 years

93. A preventive maintenance schedule with annual visits over 10 years of service life includes:

A. 10 visits

B. 9 visits

C. 12 visits

D. 15 visits

94. A service agreement with 4-hour response time means service personnel arrive on site within:

A. 4 hours of notification

B. 4 business hours of notification

C. 4 hours of arrival confirmation

D. 4 days of notification

95. An installation with 50 cables requires verification testing of each cable. At 3 minutes per cable test, total time is:

A. 125 minutes

B. 150 minutes

C. 175 minutes

D. 200 minutes

96. A rack with 35U of equipment plus 5U of blanking panels plus 2U of reserved space uses rack space of:

A. 35 RU

B. 40 RU

C. 37 RU

D. 42 RU

97. A substantial completion milestone at 85% project completion leaves remaining work of:

A. 15%

B. 10%

C. 20%

D. 25%

98. A client training session for 8 users at 45 minutes each in parallel groups of 4 takes:

A. 180 minutes

B. 135 minutes

C. 90 minutes

D. 45 minutes

99. A warranty period of 12 months plus manufacturer extended warranty of 24 months provides total coverage of:

A. 24 months

B. 36 months

C. 48 months

D. 60 months

100. A project with 500 cables tested for certification at 4 minutes per cable requires total time of:

A. 1,500 minutes

B. 1,800 minutes

C. 1,900 minutes

D. 2,000 minutes

101. A systematic verification process covers A-Level essential items first. The A-Level proportion of typical verification effort is approximately:

A. 60-70% of verification effort

B. 40-50%

C. 30-40%

D. 20-30%

102. A substantial completion certificate documents:

A. System ready for intended use with minor work remaining

B. All work complete including punch list

C. Installation cost summary

D. Warranty terms summary

Domain E — Conducting Ongoing Project Responsibilities

103. A 10-year-old installation experiencing increasing service calls, decreased reliability, and parts unavailability is approximately:

A. At beginning of service life

B. At end of service life approaching refresh

C. Due for manufacturer warranty claims

D. Due for preventive maintenance

104. A service agreement with quarterly visits over a year provides:

A. 2 visits per year

B. 3 visits per year

C. 4 visits per year

D. 6 visits per year

105. An annual preventive maintenance schedule for a 7-year service life installation includes total visits of:

A. 7 visits

B. 8 visits

C. 6 visits

D. 10 visits

106. A labor estimate of 80 hours with 20% productivity increase for evening shifts requires:

A. 90 hours

B. 95 hours

C. 100 hours

D. 96 hours

107. A 150-hour labor estimate with 15% increase for occupied building plus 10% increase for trade coordination requires approximately:

A. 175 hours

B. 189 hours

C. 195 hours

D. 200 hours

108. A project with 40% labor and 60% material cost of $100,000 total has labor cost of:

A. $30,000

B. $35,000

C. $40,000

D. $50,000

109. A change order for $5,000 on a $100,000 project represents percentage of:

A. 5%

B. 10%

C. 15%

D. 20%

110. A 30-day delay on a 180-day project represents percentage of:

A. 10%

B. 15%

C. 12.5%

D. 16.67%

111. A weekly preventive maintenance over a year includes:

A. 12 visits

B. 50 visits

C. 52 visits

D. 365 visits

112. A biannual preventive maintenance (2 times per year) over 5 years includes:

A. 8 visits

B. 10 visits

C. 12 visits

D. 5 visits

113. A 25% overrun on a 200-hour labor estimate actual hours total:

A. 250 hours

B. 240 hours

C. 275 hours

D. 300 hours

114. A project budget of $80,000 with 10% contingency has total budget of:

A. $85,000

B. $87,000

C. $88,000

D. $90,000

115. A service response time requirement of 4 business hours for a call received at 3 PM Friday (Friday close at 5 PM, Monday open at 9 AM) has service arrival by:

A. 5 PM Friday

B. 9 AM Monday

C. 11 AM Monday

D. 1 PM Monday

116. A typical AV installation service life of 7-10 years has average service life of approximately:

A. 7 years

B. 8.5 years

C. 9 years

D. 10 years

117. An installation with annual preventive maintenance visits plus 2 additional call-out services per year over 8 years has total service interactions of:

A. 24 service interactions

B. 32 service interactions

C. 40 service interactions

D. 16 service interactions

118. A project with 125 simulation exam questions reviewed at 1 minute per question total:

A. 100 minutes

B. 115 minutes

C. 125 minutes

D. 150 minutes

119. A scope change request submitted Monday receives client approval Wednesday. Resolution time is:

A. 1 day

B. 2 days

C. 3 days

D. 4 days

120. A 20% increase in labor hours on a 100-hour estimate results in actual hours of:

A. 100 hours

B. 110 hours

C. 115 hours

D. 120 hours

121. A service level agreement (SLA) with 99.9% uptime represents maximum allowed downtime per year of:

A. 8.76 hours

B. 12 hours

C. 24 hours

D. 48 hours

122. A 60-hour labor estimate with 50% productivity reduction due to difficult site conditions requires:

A. 75 hours

B. 80 hours

C. 90 hours

D. 100 hours

123. A project with 10 cables pulled at 5 feet per minute covers 300 feet in:

A. 50 minutes

B. 60 minutes

C. 75 minutes

D. 90 minutes

124. A preventive maintenance visit with 2-hour duration completed for 12 different clients consumes:

A. 18 hours

B. 20 hours

C. 22 hours

D. 24 hours

125. A 3-hour training session attended by 20 users represents training hours of:

A. 60 user-hours

B. 45 user-hours

C. 30 user-hours

D. 20 user-hours

PRACTICE EXAM 14: ANSWER KEY WITH FULL ANSWER EXPLANATIONS

Questions 1–125

Domain A — Conducting Pre-Installation Activities

1. C — 0.346 square inches. The 40% fill limit multiplied by 0.864 square inches internal area equals 0.346 square inches. This calculation determines the maximum cable cross-sectional area allowed per NEC for three or more cables in the conduit.

2. A — 1.344 square inches. The 40% fill multiplied by 3.36 square inches equals 1.344 square inches. This is the NEC-compliant maximum cable area for three or more cables in a 2-inch EMT conduit.

3. D — 1,760 feet. Each run is 80 + 4 + 4 = 88 feet including service loops; 20 runs × 88 feet = 1,760 feet total base length. This calculation captures both the physical pathway and service loops before contingency.

4. B — 2,024 feet. 1,760 feet × 1.15 (15% contingency) equals 2,024 feet. Contingency accounts for routing variations, waste at terminations, and unforeseen field conditions.

5. A — 0.0707 square inches. Cross-sectional area = $\pi \times (d/2)^2 = \pi \times (0.15)^2 = \pi \times 0.0225 \approx 0.0707$ square inches. This formula applies to all circular cable cross-sections.

6. C — 40.1%. Total cable area is 8 × 0.075 = 0.600 square inches; dividing by 1.496 square inches equals approximately 40.1%. This slightly exceeds the NEC 40% limit, requiring pathway reassessment.

7. D — 360 labels. 180 cables × 2 ends per cable = 360 labels. Bilateral labeling supports tracing from either end of each cable.

8. B — 32 feet. At 1/4" = 1'-0" scale, 8 inches × 4 feet per inch = 32 feet. Scale conversion converts drawing dimensions to actual building dimensions.

9. A — Cable ties: 140, Velcro: 70, Labels: 240. Cable ties: 220 - 80 = 140 gap. Velcro: 110 - 40 = 70 gap. Labels: 440 - 200 = 240 gap. Accurate gap calculation supports complete procurement.

10. C — 1.972 square inches. 4.93 × 0.40 = 1.972 square inches. This is the maximum cable area allowed in 2.5-inch EMT at NEC's 40% fill limit.

11. B — 132 hours. 100 × 1.20 (occupied) = 120 hours, then × 1.10 (restricted access) = 132 hours. Multiplicative productivity factors compound when conditions combine.

12. D — 380 pounds. 95 × 4 = 380 pounds minimum capacity. The 4:1 safety factor for non-overhead loads accounts for dynamic loading, fatigue, and installation imperfections.

13. C — 360 degrees. 4 bends × 90 degrees = 360 degrees cumulative. This is exactly at the NEC limit between pull points; additional bends require intermediate pull boxes.

14. A — Exceeds the NEC 40% limit and requires pathway redesign. 45% fill exceeds NEC's 40% limit for three or more cables, creating a code violation requiring resolution through pathway upsizing or cable reduction.

15. D — 0.0452 square inches. $\pi \times (0.12)^2 = \pi \times 0.0144 \approx 0.0452$ square inches. This calculation applies consistently to cable cross-sectional area analysis.

16. B — 1,344 feet. 1,200 × 1.12 (12% contingency) = 1,344 feet. Contingency percentages vary by project risk but typically range 10-15%.

17. A — 80 feet. At 1/8" = 1'-0" scale, 10 inches × 8 feet per inch = 80 feet. Smaller scales allow larger areas to fit on drawing sheets.

18. C — 21 inches. 12 RU × 1.75 inches per RU = 21 inches. Multiplying rack units by 1.75 gives precise vertical space.

19. B — 700 pounds. 175 × 4 = 700 pounds at the 4:1 non-overhead safety factor. Higher-weight equipment requires proportionally higher mount/wall capacity.

20. D — 2.952 square inches. 7.38 × 0.40 = 2.952 square inches. Three-inch EMT provides substantial cable capacity.

21. A — 78 feet. 68 + 5 + 5 = 78 feet base length including both service loops. This calculation precedes contingency application.

22. C — 12 amperes. 15 × 0.80 = 12 amperes. The 80% rule limits continuous loads to 80% of circuit rating to provide headroom against breaker trips.

23. B — 0.598 square inches. 1.496 × 0.40 = 0.598 square inches. This is the maximum cable area allowed in 1.25-inch EMT at NEC's 40% fill limit.

24. D — 187.5 hours. 150 × 1.25 = 187.5 hours. Single-factor productivity calculations apply the factor directly to base hours.

25. C — 12 feet. At 1/2" = 1'-0" scale, 6 inches × 2 feet per inch = 12 feet. Larger scales show greater detail but cover smaller areas.

26. B — 28 inches. 16 RU × 1.75 = 28 inches vertical mounting space. This is precisely calculated for all rack unit sizes.

27. D — 0.1257 square inches. $\pi \times (0.20)^2 = \pi \times 0.04 \approx 0.1257$ square inches. Larger diameter cables have substantially greater cross-sectional area.

28. A — Supervisory personnel and competent persons on construction sites. The OSHA 30-hour card provides expanded safety training required for supervisors and competent persons, distinguishing it from the 10-hour card for general workers.

Domain B — Conducting Site Rough-In/First-Fix

29. C — Exceeds NEC 360-degree limit and requires intermediate pull point. 450 degrees exceeds NEC Chapter 9's 360-degree cumulative bend limit between pull points. This requires adding an intermediate pull box to reduce cumulative bends.

30. B — 1,425 pounds. 5,700 ÷ 4 = 1,425 pounds working load. The 4:1 non-overhead safety factor provides margin for dynamic loads, fatigue, and installation imperfections.

31. D — 1,140 pounds. 5,700 ÷ 5 = 1,140 pounds working load. Overhead loads require the higher 5:1 safety factor because of the greater consequences of failure above occupied spaces.

32. A — 20 feet. At the 4-to-1 rule, base 5 feet from structure supports 5 × 4 = 20 feet working height. This ratio produces approximately 75-degree ladder angle for safe use.

33. C — 10,000 pounds. 5,000 pounds × 2 workers = 10,000 pounds minimum anchor capacity. Multiple workers attached multiply the anchor requirement proportionally.

34. B — 315 degrees. 3 × 90 + 1 × 45 = 270 + 45 = 315 degrees cumulative. This is below NEC's 360-degree limit, allowing continued pulling.

35. D — 1.40 inches. 4 × 0.35 = 1.40 inches minimum bend radius during installation. Respecting this limit prevents internal cable geometry damage.

36. A — 2,500 pounds. 10,000 ÷ 4 = 2,500 pounds working load at 4:1 safety factor. This is the non-overhead working capacity of the 1/2-inch rod.

37. C — 500 pounds. 2,500 ÷ 5 = 500 pounds working load at 5:1 overhead safety factor. The higher safety factor for overhead loads produces lower working capacity.

38. A — 30% margin. (500 - 350) ÷ 500 = 0.30 or 30% margin below maximum. This margin provides safety against exceeding manufacturer limits during variable pulling conditions.

39. D — 4 feet from structure. 16 ÷ 4 = 4 feet. The 4-to-1 rule means the base extends 1 foot per 4 feet of working height, producing stable climbing angle.

40. C — 10 J-hooks. 50 feet ÷ 5 feet per J-hook = 10 J-hooks needed for the run. This standard spacing supports typical Category cable without excessive sag.

41. A — 2.0 inches. 8 × 0.25 = 2.0 inches minimum bend radius in installed position. Installed position uses the looser 8× diameter limit versus 4× during pulling.

42. B — 6 feet or greater. OSHA construction fall protection (29 CFR 1926 Subpart M) requires fall protection at 6 feet or greater. This is the standard construction site trigger.

Domain C — Installing Audiovisual Systems

43. D — 73.5 inches. 42 RU × 1.75 = 73.5 inches. Full-size racks provide substantial vertical equipment capacity.

44. C — 43.75 inches. 25 RU × 1.75 = 43.75 inches. Accurate calculation requires the exact 1.75 multiplier.

45. A — 24 amperes. 30 × 0.80 = 24 amperes continuous load limit. This protects against sustained near-rated current draw causing breaker trips.

46. B — 682 BTU/hour. 200 × 3.412 = 682 BTU/hour. The factor 3.412 converts watts to BTU/hour for HVAC calculations.

47. D — 1,706 BTU/hour. 500 × 3.412 = 1,706 BTU/hour. Larger heat loads require proportionally more cooling capacity.

48. C — 480 watts. 600 ÷ 1.25 = 480 watts. Professional practice sizes amplifiers at 125% of tap load, providing 80% utilization and operating headroom.

49. B — 280 watts. 12 × 10 + 8 × 20 = 120 + 160 = 280 watts total tap load. Summing all loudspeaker taps gives the amplifier demand.

50. A — 280 watts. 350 ÷ 1.25 = 280 watts maximum tap load. This preserves the 80% utilization standard.

51. A — 1.33 ohms. 4 ÷ 3 ≈ 1.33 ohms. Three equal parallel impedances equal one impedance divided by three.

52. C — 2 ohms. 8 ÷ 4 = 2 ohms. Four equal 8-ohm loudspeakers in parallel halve the impedance twice.

53. B — 0.40 ohms. 5% of 8 ohms = 0.40 ohms maximum cable resistance. This limit preserves power transfer efficiency and prevents protection circuit triggering.

54. D — 0.20 ohms. 5% of 4 ohms = 0.20 ohms. Lower impedance loudspeakers have proportionally lower cable resistance tolerance.

55. A — 0.80 ohms. 5% of 16 ohms = 0.80 ohms. Higher impedance loudspeakers tolerate higher cable resistance.

56. C — 4 ohms. Two 8-ohm loudspeakers in parallel: 8 ÷ 2 = 4 ohms. Two equal parallel impedances halve the single impedance.

57. B — 2:1. A 3 dB power increase represents 2× power ratio. This is one of the key decibel reference values.

58. D — 4:1. A 6 dB power increase represents 4× power ratio. Also corresponds to 2× voltage ratio since power scales with voltage squared.

59. A — 10:1. A 10 dB power increase represents 10× power ratio. The dB scale is logarithmic with 10 dB representing one decade of power.

60. C — 100:1. A 20 dB increase represents 100× power ratio. Each 10 dB increment multiplies the ratio by 10.

61. B — 2:1. A 6 dB voltage increase represents 2× voltage ratio. Voltage uses the 20 × log multiplier rather than 10 × log used for power.

62. D — 4.5 Gbps. 1080p60 at 8-bit color requires approximately 4.5 Gbps bandwidth. This is a fundamental bandwidth specification for HD video.

63. A — 24 Gbps. 4K60 at 10-bit color with HDR requires approximately 24 Gbps, exceeding HDMI 2.0's 18 Gbps capacity.

64. C — 10.2 Gbps. 4K30 at 8-bit color requires approximately 10.2 Gbps bandwidth. Lower frame rate reduces bandwidth compared to 4K60.

65. B — 500 MHz. Cat6A supports 500 MHz maximum frequency, twice Cat6's 250 MHz and supporting 10GBase-T.

66. D — 250 MHz. Cat6 supports 250 MHz maximum frequency, midway between Cat5e (100 MHz) and Cat6A (500 MHz).

67. C — 300 meters. OM3 multimode fiber supports 10 Gbps Ethernet to 300 meters, substantially exceeding copper limits.

68. A — 400 meters. OM4 multimode fiber supports 10 Gbps Ethernet to 400 meters, improving on OM3's 300-meter capability.

69. D — 100 meters. HDBaseT supports 4K60 over Cat6A to 100 meters, matching general Ethernet limits.

70. B — 25.5 watts. IEEE 802.3at (PoE+) provides 25.5 watts at the powered device, with 30 watts at the source.

71. C — 12.95 watts. IEEE 802.3af (basic PoE) provides 12.95 watts at the powered device, with 15.4 watts at the source.

72. A — 71 watts. IEEE 802.3bt Type 4 provides 71 watts at the powered device, with 100 watts at the source.

73. D — 254. A /24 subnet provides 256 total addresses minus 2 reserved (network and broadcast) = 254 usable host addresses.

74. B — 126. A /25 subnet provides 128 total addresses minus 2 reserved = 126 usable host addresses.

75. A — 0.25 to 1 millisecond. Dante audio networking operates with extremely low latency at standard settings, essential for professional audio.

76. D — 10 Gbps. SDVoE distributes uncompressed 4K60 video requiring 10 Gbps Ethernet infrastructure plus protocol overhead.

77. A — 10 feet. Image width = distance ÷ throw ratio = 22 ÷ 2.2 = 10 feet. This formula determines image size from projector positioning.

78. C — 15 feet. Image width = 27 ÷ 1.8 = 15 feet. The same formula applies to all throw ratio calculations.

79. B — 15 feet. Image width = 30 ÷ 2.0 = 15 feet. Throw ratio calculations are fundamental to projector positioning planning.

80. D — 8 times image height. AVIXA DISCAS recommends 8× image height maximum viewing distance for basic decision-making content (text readable from back).

81. A — 4 times image height. Analytical decision-making content requires shorter 4× image height maximum viewing distance, half the basic distance for finer detail discrimination.

82. C — 2.2. Standard video content is encoded for gamma 2.2, matching human visual perception and content encoding standards.

83. B — 6500K (D65). D65 white point at 6500 Kelvin is the standard for video content calibration.

84. D — 48 volts DC. Phantom power for condenser microphones is standardized at 48V DC.

85. A — 0.5 inches. Cat6A cable specifications permit maximum 0.5 inches of untwist at termination to preserve high-frequency performance.

86. C — 320 watts. 400 ÷ 1.25 = 320 watts. Professional 125% sizing provides operating headroom for amplifiers.

87. B — 250 watts. 20 × 5 + 10 × 15 = 100 + 150 = 250 watts total tap load.

88. D — 800 watts. 1000 ÷ 1.25 = 800 watts maximum tap load. The 125% sizing rule applies at all amplifier capacities.

Domain D — Perform Systems Close-Out

89. A — A-Level, B-Level, C-Level. ANSI/AVIXA 10:2013 uses this three-level structure categorizing verification items as essential, specialized, and unique.

90. C — 40%. 8 substantive ÷ 20 total = 40%. Percentage calculations support punch list priority assessment.

91. B — January 15 following year. A 12-month warranty period from January 15 expires exactly 12 months later on January 15 of the following year.

92. D — 2 years. 7 years service life - 5 years elapsed = 2 years remaining. Service life tracking supports refresh planning.

93. A — 10 visits. Annual visits × 10 years = 10 visits total. Preventive maintenance planning multiplies visit frequency by service life.

94. C — 4 hours of arrival confirmation. Service level agreements typically define response time as time to arrival, with specific definitions varying by contract terms.

95. B — 150 minutes. 50 cables × 3 minutes = 150 minutes total test time. Planning calculations support schedule development.

96. D — 42 RU. 35 + 5 + 2 = 42 RU total rack space used including equipment, blanking panels, and reserved space.

97. A — 15%. 100% - 85% = 15% remaining work. Percentage calculations support progress tracking and completion planning.

98. C — 90 minutes. Two parallel sessions of 45 minutes each = 90 minutes total. Parallel execution reduces total elapsed time.

99. B — 36 months. 12 months + 24 months = 36 months total warranty coverage. Warranty extensions add to base coverage periods.

100. D — 2,000 minutes. 500 × 4 = 2,000 minutes total test time. Large cable counts require significant testing effort.

101. A — 60-70% of verification effort. A-Level items typically represent the majority of verification effort because they cover essential system functions that must be verified on every installation.

102. D — Warranty terms summary. The certificate documents system readiness at milestone achievement with remaining punch list items scheduled for completion.

Domain E — Conducting Ongoing Project Responsibilities

103. B — At end of service life approaching refresh. Increasing service calls, decreasing reliability, and parts unavailability are classic end-of-life indicators signaling approaching refresh.

104. C — 4 visits per year. Quarterly visits × 4 quarters = 4 visits per year. Maintenance scheduling directly corresponds to agreed frequency.

105. A — 7 visits. Annual visits × 7 years = 7 visits total during service life.

106. D — 96 hours. 80 × 1.20 = 96 hours with 20% productivity increase. Evening shift productivity reductions are applied multiplicatively.

107. B — 189 hours. 150 × 1.15 × 1.10 = 189.75, approximately 189 hours. Compound productivity factors apply multiplicatively.

108. C — $40,000. 40% × $100,000 = $40,000 labor cost. This is standard percentage-of-total calculation.

109. A — 5%. $5,000 ÷ $100,000 = 5%. Change order percentages measure contract impact.

110. D — 16.67%. 30 ÷ 180 = 16.67%. Delay percentages measure impact relative to original schedule.

111. C — 52 visits. Weekly visits × 52 weeks = 52 visits per year. Weekly maintenance is substantial investment.

112. B — 10 visits. 2 visits per year × 5 years = 10 visits total. Biannual scheduling doubles annual frequency.

113. A — 250 hours. 200 × 1.25 = 250 hours with 25% overrun. Overruns add to baseline hours.

114. C — $88,000. $80,000 × 1.10 = $88,000 with 10% contingency. Contingency adds percentage margin to baseline.

115. D — 1 PM Monday. Business hours only: Friday 3-5 PM = 2 hours, Monday 9-11 AM needs 2 more hours, totaling 4 hours. Service arrives by 1 PM Monday considering business hours definition.

116. B — 8.5 years. (7 + 10) ÷ 2 = 8.5 years average. Range-based averages use midpoint calculation.

117. A — 24 service interactions. 1 annual + 2 additional = 3 per year × 8 years = 24 total. Comprehensive service tracking combines scheduled and unscheduled visits.

118. C — 125 minutes. 125 questions × 1 minute = 125 minutes. Straightforward multiplication for planning purposes.

119. B — 2 days. Monday to Wednesday = 2 days elapsed. Resolution tracking measures elapsed time.

120. D — 120 hours. 100 × 1.20 = 120 hours with 20% increase. Direct percentage applications scale baseline values.

121. A — 8.76 hours. 365 days × 24 hours × 0.1% = 8.76 hours. 99.9% uptime allows 0.1% downtime per year.

122. C — 90 hours. 60 × 1.50 = 90 hours. A 50% productivity reduction effectively increases hours by 50%.

123. B — 60 minutes. 300 feet ÷ 5 feet per minute = 60 minutes. Linear rate calculations determine time requirements.

124. D — 24 hours. 12 clients × 2 hours = 24 hours total. Multiple-client scheduling totals individual visit durations.

125. A — 60 user-hours. 20 users × 3 hours = 60 user-hours. User-hours measure total training investment across participants.