1. ________ describes a situation in the imaging department where images are produced, analyzed, distributed, and stored in electronic form.
A DICOM   B RAM   C PACS   D HMO

2. General radiography probably accounts for ________ % of diagnostic imaging workloads.
A 70   B 90   C 50   D 38

3. The best configuration for a PACS network is to be physically ________ (typically by means of switches) the hospital backbone.
A dominant over   B integrated in   C partially integrated in   D isolated from

4. Images/exams are sent to the PACS image server, where they will be stored on the system RAID (——— array of independent discs).
A redundant   B rapid   C ready   D radiological

5. DICOM (Digital Imaging and Communications in Medicine) links an information object with a service class to create a SOP (———).
A simple-object pair   B service-object pair   C service-operation pair   D service-object pipe

PART TWO: NUCLEAR MEDICINE IMAGING TECHNOLOGY

6. Approximately ________ % diagnostic nuclear medicine imaging procedures are performed in the United States each year.
A 5   B 11   C 16   D 22

7. Scintillation camera technology accounts for more than ________ % of the imaging procedures performed in nuclear medicine.
A 70   B 82   C 88   D 95

8. The majority of SPECT systems used in nuclear medicine typically employ ________ detectors.
A 1-3   B 5-6   C 7   D 10

PART THREE: COMPUTED TOMOGRAPHY: TECHNOLOGY UPDATE...

9. Helical CT scanners have no inertial limitations during the scan cycle since both the gantry and table move ________ during the scan.
A in 'stop-n-go' fashion   B at constant velocity   C with acceleration   D with deceleration

10. The collimated slice thickness is ________ than the dimensions of an individual detector in multiple detector array systems.
A always smaller   B usually greater   C always greater   D usually smaller

11. As part of acceptance testing a new scanner, the computed tomography ________ index (CTDI) should be measured.
A disc   B deployment   C dose   D detector

12. CTDI values are often computed in plastic, and it is not important for any reason to compute the tissue (or water equivalent) dose.
A True   B False

13. The author describes a robust method of assigning studies to particular radiologists with applied computer parameters, referred to as the:
A Bowman logic approach   B Baugh logic approach   C Beam logic approach   D Boolean logic approach

14. The CT scanner console can act as either a service class user (SCU) or a service class ________ (SCP), depending on the function.
A provider   B parameter   C port   D portal

PART FOUR: MAGNETIC RESONANCE IMAGING AND PACS

15. According to the text, MRI is an evolving technology capable of acquiring large numbers of images (———) in a single examination.
A >20   B >100   C >500   D >1000

16. “——— space” is a term for the raw data space that will be transformed to yield the MR image.
A r-   B x-   C k-   D z-

17. MR and CT are capable of acquiring ________ data – image data where the scale of the pixel dimensions are equal in all three planes.
A lipotropic   B xenotropic   C isotropic   D hydrotropic

18. The TOF technique works best for relatively rapid flow that is ________ to the slices in the imaging volume.
A parallel   B perpendicular   C at 45 degrees   D at 25 degrees

19. Interventional MRI (iMRI) systems typically use ________ field magnets versus conventional systems.
A slightly higher   B similar   C significantly   D lower
20. The image intensifier was developed in the ——— to electro-optically increase the available light level during fluoroscopy.
   A 1940s  B 1950s  C 1960s  D 1970s

21. The contrast ——— is a measure of the ability of an image intensifier to produce contrast in the image of a radio-opaque object.
   A index  B marker  C ratio  D formula

22. Video camera characteristics that affect fluoroscopic imaging include all the following except:
   A lag  B dynamic range  C spatial distortion  D pitch

PART SIX: FILM DIGITIZERS AND LASER PRINTERS

23. Film digitizers convert the continuous optical density (OD) variations on analog film into a(n) ——— image.
   A digital  B latent  C inverted  D ‘jpg file’

24. ——— response refers to the ability of the digitizer to accurately render the optical density variations.
   A image  B contrast  C spatial  D photon

25. Veiling glare is a low frequency degradation affecting the ——— areas in the digitized image.
   A colored  B light  C dark  D peripheral

26. Daily film digitizer QC involves digitizing a calibrated step wedge that spans an OD range of at least 0.1 to:
   A 1.0  B 2.0  C 3.0  D 4.0

27. Pixel ——— is the center-to-center spacing of the pixel areas on the film.
   A loudness  B variance  C pitch  D matrix

28. ——— processing is a dry laser technology that was introduced by Polaroid Medical Imaging Systems in 1993.
   A Microcapsule  B Silver emulsion thermal  C Convex  D Adherographic

PART SEVEN: COMPUTED RADIOGRAPHY OVERVIEW

29. Computed Radiography (CR) refers to projection x-ray imaging using photostimulable or ——— phosphors.
   A storage  B container  C cup  D canteen

30. The spatial resolution response or sharpness of an image capture process can be expressed in terms of its ——— transfer function (MTF).
   A modulation  B middle  C movement  D minus

31. Regarding CR noise, the dose-dependent noise components can be classified into x-ray quantum noise, or ———, and light photon noise.
   A muddle  B mottle  C haze  D fog

32. Spatial frequency processing, sometimes called ——— enhancement, is an important part of CR image processing.
   A edge  B sharp  C filter  D line

33. Multiscale image contrast ——— (MUSICA) is a very flexible advanced image processing algorithm.
   A amperes  B altitude  C algorithm  D amplification

PART EIGHT: COMPUTED RADIOGRAPHY: QA/QC

34. Collimation and light-field convergence are ——— critical to CR image quality versus SF (standard film) image quality.
   A slightly less  B more  C equally  D very much less

35. Regarding correcting suboptimal images in CR, increasing mAs improves only:
   A density  B contrast  C noise  D gray-scale length

36. An problem in early CR cassettes was the ——— artifact, which was the image of a clip on the back of the imaging cassette.
   A clippy  B spaceship  C vase  D tombstone

37. The first phase of AT ——— testing) is to conduct a component inventory and inspection.
   A acceptance  B adequate  C accrual  D ampere

PART NINE: DIGITAL MAMMOGRAPHY

38. Mortality from breast cancer can be reduced if the cancer is detected in situ (within the ductal system).
   A True  B False

39. There is an increased radiation dose (by a factor of ——— ) to the patient when using a radiographic grid compared with not using grid.
   A 4-5  B 6  C 2-3  D 7
40. Digital detectors can be of two general types, __________ sensors or replaceable cassettes.
   A carry-over  B captive  C photon  D LED

41. The sampling theorem states that only spatial frequencies in a special pattern (the ________ frequency) can be faithfully imaged.
   A Nyquist  B Neville  C Nordic  D Nerlander

42. Digital Mammography requires __________, i.e., a constant sensitivity over the entire area of the image.
   A contrast  B resolution  C density  D uniformity

43. Probably the most widespread detectors for digital radiography to date have been __________ phosphors, also known as storage phosphors.
   A light-sensing  B photostimulable  C electro-beam  D zaplight

44. Scatter can be reduced either by using a narrow beam scanned acquisition technique or, in the case of an area detector, using a:
   A grid  B filter  C kVp increase  D step wedge

45. In many cases, even state-of-the-art CRT monitors are not able to display a full digital mammogram at more than ½ its spatial resolution.
   A True  B False

46. Digital imaging allows for image data manipulation. This advantage is apparent in ________ (a refinement of blurring tomography).
   A teletomography  B dual energy tomography  C tomosynthesis  D image cohesion

47. The ________ is the signal-to-noise ratio of the output image.
   A effective resolution  B noise equivalent quanta  C detective quantum efficiency  D dynamic range

48. With digital technologies, the operator has less control over the radiographic parameters of kVp and mAs versus film based technologies.
   A True  B False

49. ________ is a measure of the relative brightness difference between two locations in an image.
   A density  B spatial resolution  C aspect ratio  D contrast

50. Image ________ may be defined as random variations in image signals.
   A contrast  B noise  C density  D range

51. X-ray interactions in a radiographic screen produce a small flash of light that consists of a large number of quanta (typically ________).
   A 50-100  B 150-250  C 300-400  D 500-1000

52. Units of the NPS (noise-power ________) depend on the physical basis of the image signal.
   A spectrum  B server  C solenoid  D sensitivity

53. One effect of the detector in the Fourier domain is to attenuate spatial frequencies by the presampling MTF (modulator-transfer ________).
   A frequency  B Fourier  C function  D fixture

54. A numerical implementation of the Fourier transform is called a ________ Fourier transform (DFT).
   A double  B discrete  C detector  D dose

55. The entities comprising corresponding layers on the network devices are termed:
   A levels  B peers  C sub domains  D compartments

56. The open systems ________ (OSI) model establishes a framework for defining standards for linking heterogeneous computer networks.
   A interconnection  B intermodal  C internet  D intercom

57. Regarding WANs (wide area networks), the ________ provide a switching matrix for the data to reach its final destination.
   A LANs (local area networks)  B frame relays  C PDUs (protocol data units)  D nodes

58. ________ is an example of a round-robin-distributed MAC protocol that uses a token mechanism for channel bandwidth allocation.
   A FDDO  B DDFI  C FDDI  D IDFD

59. ATM (________ transfer mode) can be used in the implementation of LANs by various means.
   A automatic  B aperture  C asynchronous  D area
PART TWELVE: INTRODUCTION TO DICOM

60. Regarding the ISO 7-layer network model, layer 3 is called ______, and it has to do with switches and routes information.
   A presentation  B session  C application  D network

61. A service-object- ______ (SOP) is a concrete occurrence of an information object and communication context.
   A pair  B pixel  C pole  D provider

62. Regarding the 14 parts of the DICOM base standard, part 2, called ______, defines the structure for the required documentation.
   A service class specifications  B conformance  C data dictionary  D message exchange

63. Regarding the 14 parts of the DICOM base standard, part 7, called ______, defines the structure for DICOM services and messaging.
   A data dictionary  B message exchange  C servicing network  D data encoding

64. Regarding the 14 parts of the DICOM base standard, part 14 is called ______ standard display function.
   A contrast  B pixel  C greyscale  D brightness

65. A modality device can acquire requisite patient/study information from a worklist server such as RIS (______ information systems).
   A radiology  B requisite  C recall  D ready

66. It is the author’s opinion that no DICOM device (except ______) should be purchased that does not support HIS/RIS integration.
   A image monitors  B printers  C transcription devices  D patient data ports

PART THIRTEEN: DIAGNOSTIC AND ACCEPTANCE TESTING

67. The DICOM standard traces its history back to ______ as a joint effort between the ACR and NEMA.
   A the early 1980s  B the late 1990s  C 2002  D 2004

68. The ______ purchasing model (of DICOM devices) can be proved to create a set of devices that will successfully communicate.
   A conformant-limit  B block method  C closed-set  D open-loop

69. The DICOM conformant-limit purchasing model (of DICOM devices) cannot even create a set of two communicating devices.
   A True  B False

PART FOURTEEN: PACS BROKERS: THE RIS AND HIS

70. Image acquisition combined with image management and interpretation are generally considered together as:
   A EMR  B HIS  C RIS  D PACS

71. Regarding data and image flow, an examination may be ordered through the ACP. A(n) ______ Number is then generated by RIS.
   A Portal  B Interface  C Accession  D Linking

72. Following the step in question 71, the RIS sends the order to a computer which can communicate with both the RIS and ACP – called a:
   A PACS broker  B ACP interchange  C ACP broker  D PACS interchange

73. The RIS interface, fundamentally, is the set of communication protocols for exchange of ______ between systems.
   A single image data  B series image data  C patient information  D exam technical factors

PART FIFTEEN: INTEGRATED MEDICAL IMAGING...

74. ______ is an internet communication protocol that standardizes communication between devices dealing with patient data and/or HIS.
   A HL-4  B HL-7  C HL-2  D HL-5

75. ______ allows reduction in large file sizes to more manageable sizes for transfer via networks.
   A Compression  B Convergence  C Conversion  D HTTP

76. With a ______:1 compression ratio all data are preserved within half the storage space.
   A 3  B 2  C 5  D 4

PART SIXTEEN: IMAGE COMPRESSION AND ENCRYPTION

77. ______ image compression algorithms are those in which the original image and compressed image are identical on a bit-by-bit basis.
   A irreversible  B reversible  C complex  D simple

78. Regarding image _______, the image data are transformed into a spectral domain defined by the particular basis function set.
   A quantization  B encoding  C transformation  D transference

79. ______ is the single step of the compression process that introduces irreversible alteration of the image data.
   A Encoding  B Transformation  C Transference  D Quantization
80. ______ encoding exploits sequences of neighboring pixels in image lines or columns that are found to have the same value.
   A Stream  B Direct  C Tapered  D Run-length

81. In general, the image data alteration caused by irreversible compression algorithms are blurring and:
   A artifacts  B fogging  C image cut off  D ‘lightning’ image patterns

82. As the image compression ratio increases, blurring and incidence of artifacts:
   A increases  B decreases  C stays constant  D may go up or down

83. Human ______ system (HVS) weighting in JPEG/wavelet compression algorithms can optimize the quantization of spectral coefficients.
   A visual  B variance  C visceral  D voxel

84. ______ involves the use of mathematical data transformation for mapping "plain-text" data into scrambled "ciphertext".
   A Decryption  B Text transfer  C Encryption  D Coding

85. Teleradiology, though undergoing great changes due to technological advancement, has been around for greater than ______ years.
   A 15  B 18  C 22  D 25

86. In 1994, the ACR (——— College of Radiology) published the first ACR Standard for Teleradiology.
   A Associated  B American  C Accredited  D Advancement

87. ______ digitizers use a highly focused, intense, and phase coherent beam of light to scan the film.
   A Laser film  B Charged coupled device  C Light scan  D Charged quad loop

88. ______ radiography employs reusable storage phosphor plates in cassettes that take the place of the screen-film cassette imaging.
   A Conventional  B Computed  C Remote  D High resolution

89. Under extreme compression ratios wavelets generally degrade more gracefully than JPEG compressed images.
   A True  B False

90. ______ is the transformation of data to conceal its information content, prevent undetected modification, and prevent unauthorized use.
   A SSL  B Encryption  C MIME  D Symmetric socket inversion

91. Regarding the workstation environment, the big five reading room variables are: light, noise, motion, temperature and humidity, and:
   A wall color  B ceiling height  C space  D flooring implications

92. Regarding noise and motion, high ceilings with sound-absorbing tiles (painted ______) can help and are inexpensive to implement.
   A brown  B white  C gray  D black

93. Essential requirements for the GUI (graphical user interface) state that it must ______, efficient, and user-friendly.
   A be intuitive  B be black and white only  C be multi-colored  D display on a 19 in. monitor

94. The first step toward acceptance testing of the workstation from a DICOM/IO perspective is to review the DICOM ______ statements.
   A technical  B conformance  C copyright  D summary

95. Regarding the reproduction of tests for output to hardcopy, certain data should be maintained including all the following except:
   A window/level  B magnification  C exam indication  D annotation level

96. ______ measure the luminance or light output from monitors.
   A Light-o-gauges  B Photo chambers  C Photometers  D Light sticks

97. Regarding the IRR (——— rate of return) business plan, calculations provide a measurement of the effective rate of return on investing.
   A imaging  B internal  C indexed  D implied

98. According to the author, the main issue in creating an RFP (request for proposal) for a PACS system is to be sufficiently detailed:
   A regarding the price  B in the document (whole)  C regarding computer specs  D in the power requirements

99. In the RFP example, the introduction states that the organization’s goal for the Diagnostic Imaging Service is to become fully digitized in:
   A general xray  B surgery  C the ER  D all imaging modalities
100. In the RFP example, the pricing summary sheet states that this form must be completed by:
A the radiologist group  B imaging department  C hospital board  D vendor

101. Section 6.1 of the RFP states that the new equipment must pass hospital inspection for safety, performance, and compliance — called:

102. Section 10.2 of the RFP states that the vendor will give service instruction to the engineers:
A only on request  B during the warranty period  C anytime after purchase  D only at extra cost

103. Section 13.5 of the RFP defines system downtime as ———— failure to function.
A total system  B 50% of system  C 70% of system  D 90% of system

104. In consideration for system requirements, it is noted that with CT ———— % of raw data is saved — post-processing is immediate.
A 25  B 50  C 100  D 0

105. Regarding on-line storage, a RAID (——— Array of Independent Discs) will be placed in the network.
A Redundant  B Recall  C Real-Time  D Rotating

106. Section 3.20 of the Specifications section of the RFP pertains to image:
A hard drive storage  B recall  C transference  D analysis/manipulation

107. Section 5.6 of the Specifications section of the RFP pertains to CPU:
A speed proposed  B speed recommended  C Bus bit size  D replacement cost

108. Section 6.14 of the Specifications section of the RFP pertains to image:
A formats available  B accession numbers  C pixel display  D rotation

109. Section 11.14 of the Specifications section of the RFP pertains to image:
A rotation  B preview  C density resolution  D color

PART TWENTYTWO: A PACS CASE STUDY

110. Before PACS was implemented in the Medical University of South Carolina, the 2,000 sq. ft. film library had annual cost of:
A $33,000  B $45,000  C $56,000  D $72,000

111. Although the ultrasound mini-PACS in the case study proved successful, it only held about ———— months of on-line data.
A 1  B 2  C 3  D 4

112. The case study reported that installing disk capture systems was avoided with nuclear medicine due to the:
A camera’s internal computers  B lack of need for them  C technologist’s verbal report  D sharp rise in associated costs

113. At the time of writing, the current PACS system held approximately ———— months of on-line data.
A 24  B 18  C 12  D 7

PART TWENTYTHREE: DATA MANAGEMENT AND ARCHIVE SYSTEMS

114. Regarding the prototypical storage model in data management, the ———— layer represents the highest level.
A storage management  B application  C physical storage  D data management

115. The ———— layer manipulates the data only at the request of the application layer in the prototypical storage model.
A physical storage  B storage management  C data management  D file and file system

116. The ———— layer provides standard formalisms to move data to and from physical hardware in the prototypical storage model.
A file management  B application  C storage management  D data management

PART TWENTYFOUR: BASIC ULTRASOUND IMAGING

117. Regarding ultrasound imaging, ———— m/s is considered the average speed of sound in soft tissue.
A 530  B 740  C 1260  D 1540

118. Ultrasound images are by acquired transmitting acoustic pulses along beam lines and receiving ———— along each line.
A electric pulses  B visual beams  C echoes  D thermal pulses

119. Ultrasound pulses propagating through tissue undergo preferential attenuation of ———— frequency components.
A higher  B lower  C every  D flatter

120. The spatial resolution available in modern scanners is determined for the most part by the ———— performance.
A transducer  B CPU (central processing unit)  C storage devices  D monitor
Fill in each blank. There are two options to submit the post-test.

Option 1: Submit the post-test answers online at radunits.com on the course page under Step 3 for instant grading and emailed CE certificate. A password is required, which is found in your email receipt.

Option 2: Fax this answer sheet to us at 866-386-0472, or you may instead email a phone pic of the answer sheet to clark@radunits.com. Allow 2 days for grading, and we will email the CE certificate.

First name: 
Last name: 
Email: 
ARRT license number: 

Florida techs only - enter state license number. All others enter N/A.

Telephone: Date:

When part of a group order or if the post-test is purchased under another name – enter the order number or purchaser’s name:

<table>
<thead>
<tr>
<th></th>
<th>25</th>
<th>49</th>
<th>73</th>
<th>97</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26</td>
<td>50</td>
<td>74</td>
<td>98</td>
</tr>
<tr>
<td>2</td>
<td>27</td>
<td>51</td>
<td>75</td>
<td>99</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
<td>52</td>
<td>76</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
<td>53</td>
<td>77</td>
<td>101</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>54</td>
<td>78</td>
<td>102</td>
</tr>
<tr>
<td>6</td>
<td>31</td>
<td>55</td>
<td>79</td>
<td>103</td>
</tr>
<tr>
<td>7</td>
<td>32</td>
<td>56</td>
<td>80</td>
<td>104</td>
</tr>
<tr>
<td>8</td>
<td>33</td>
<td>57</td>
<td>81</td>
<td>105</td>
</tr>
<tr>
<td>9</td>
<td>34</td>
<td>58</td>
<td>82</td>
<td>106</td>
</tr>
<tr>
<td>10</td>
<td>35</td>
<td>59</td>
<td>83</td>
<td>107</td>
</tr>
<tr>
<td>11</td>
<td>36</td>
<td>60</td>
<td>84</td>
<td>108</td>
</tr>
<tr>
<td>12</td>
<td>37</td>
<td>61</td>
<td>85</td>
<td>109</td>
</tr>
<tr>
<td>13</td>
<td>38</td>
<td>62</td>
<td>86</td>
<td>110</td>
</tr>
<tr>
<td>14</td>
<td>39</td>
<td>63</td>
<td>87</td>
<td>111</td>
</tr>
<tr>
<td>15</td>
<td>40</td>
<td>64</td>
<td>88</td>
<td>112</td>
</tr>
<tr>
<td>16</td>
<td>41</td>
<td>65</td>
<td>89</td>
<td>113</td>
</tr>
<tr>
<td>17</td>
<td>42</td>
<td>66</td>
<td>90</td>
<td>114</td>
</tr>
<tr>
<td>18</td>
<td>43</td>
<td>67</td>
<td>91</td>
<td>115</td>
</tr>
<tr>
<td>19</td>
<td>44</td>
<td>68</td>
<td>92</td>
<td>116</td>
</tr>
<tr>
<td>20</td>
<td>45</td>
<td>69</td>
<td>93</td>
<td>117</td>
</tr>
<tr>
<td>21</td>
<td>46</td>
<td>70</td>
<td>94</td>
<td>118</td>
</tr>
<tr>
<td>22</td>
<td>47</td>
<td>71</td>
<td>95</td>
<td>119</td>
</tr>
<tr>
<td>23</td>
<td>48</td>
<td>72</td>
<td>96</td>
<td>120</td>
</tr>
</tbody>
</table>