

Computed Tomography

Chapter 1

1. Who developed the first clinically useful CT scanner for imaging the brain?
 - a. Allan Cormack
 - b. Godfrey Hounsfield
 - c. Robert Ledley
 - d. Douglas Boyd
2. Who did Dr. Hounsfield share the Nobel Prize with in 1979?
 - a. Robert Ledley
 - b. Douglas Boyd
 - c. Allan Cormack
 - d. James Ambrose
3. What year was the first high-speed CT installed?
 - a. 1973
 - b. 1974
 - c. 1975
 - d. 1976
4. What year was the multislice CT introduced?
 - a. 1995
 - b. 1996
 - c. 1997
 - d. 1998
5. The first multislice CT scanned how many slices per revolution?
 - a. > 1
 - b. > 2
 - c. > 3
 - d. > 4
6. What is CT imaging of blood vessels opacified by contrast media called?
 - a. Three-dimensional imaging
 - b. CT endoscopy
 - c. CT angiography
 - d. CT fluoroscopy

Chapter 2

7. The development of digital image-processing techniques can be attributed to work at _____.
 - a. Boeing
 - b. Laclede Martin
 - c. NASA
 - d. Raytheon
8. Pixels in a digital image represents the information contained in a volume of what in a patient?
 - a. Water
 - b. Fat
 - c. Tissue
 - d. Bone

9. The number of bits per pixel is called the bit _____.
- Depth
 - Level
 - Shape
 - Color
10. Which of the following **is not** a digitization step?
- Scanning
 - Bundling
 - Sampling
 - Quantization
11. What are the two important characteristics of the analog-to-digital conversion?
- Speed and operation
 - Operation and accuracy
 - Speed and accuracy
 - Speed and restoration
12. Which of the following **is not** a fundamental of digital image processing?
- Image enhancement
 - Image restoration
 - Image compression
 - Image transfer
13. Gray-level mapping is also called what?
- Contrast edging
 - Contrast transformation
 - Contrast enhancement
 - Contrast mapping

Chapter 3

14. What is the major shortcoming of radiography?
- Superimposition of all structures on the film
 - Poor image resolution
 - Difficult to adjust contrast
 - Patient motion causing blurred images
15. What refers to the systematic collection of information from the patient to produce the CT image?
- Image capture
 - Image processing
 - Image acquisition
 - Image selection
16. What is the reduction of the intensity of a beam of radiation as it passes through an object called?
- Transmission
 - Absorption
 - Conversion
 - Attenuation

17. The contrast factor is determined by what value?
- a. C
 - b. L
 - c. K
 - d. P
18. What is the range of numbers in the CT image called?
- a. Window width
 - b. Gray scale
 - c. Contrast
 - d. Window level
19. The presence of metallic objects **is not** a limitation of CT.
- a. True
 - b. False

Chapter 4

20. What generation CT scanner features two types of beam geometrics?
- a. Second
 - b. Third
 - c. Fourth
 - d. Fifth
21. What generation is the electron beam scanner?
- a. Fourth
 - b. Fifth
 - c. Sixth
 - d. Seventh
22. Which of the following **is not** a slip-ring design?
- a. Disk
 - b. Pancake
 - c. Cylinder
 - d. Circular
23. The major advantage of the slip-ring is the continuous rotation of the x-ray tube so that volume data can be acquired quickly from the patient.
- a. True
 - b. False
24. Collimation in CT affects patient dose and _____.
- a. Image quality
 - b. Image filtration
 - c. Image artifacts
 - d. Image capture
25. Which of the following **is not** a detector characteristic?
- a. Collimation
 - b. Efficiency
 - c. Response time
 - d. Accuracy

26. What company developed the Stellar Detector?
- Phillips
 - G.E.
 - Siemens
 - Toshiba
27. What company introduced the first dual-slice volume CT scanner?
- Elscint
 - G.E.
 - Phillips
 - Siemens

Chapter 5

28. Which reconstruction algorithm does not require much understanding of mathematics?
- Iterative
 - Back-projection
 - Summation method
 - B & C
29. The filtered back-projection is also referred to as what?
- Fourier reconstruction algorithm
 - Convolution method
 - Iterative algorithm
 - Back-projection algorithm
30. What reconstruction method is used in MRI, but not in modern CT scanners?
- Fourier reconstruction
 - Iterative algorithm
 - Filtered-back projection
 - Back projection
31. Which of the following **is not** a type of data?
- Raw data
 - Image data
 - Spatial data
 - Measurement data

Chapter 6

32. Which of the following is a step in the IR process?
- Input
 - IR loop
 - Output
 - All the above

33. Which IR process forms the basis of the iterative reconstruction?
- IR loop
 - Input
 - Output
 - B & C
34. What term is used to refer to the characteristics of the CT imaging system and the imaged object?
- Projection
 - Components
 - Criteria
 - Modeling
35. What was the first commercially available algorithm?
- Vevo model-based IR algorithm
 - ASiR algorithm
 - IRIS algorithm
 - SAFIRE algorithm
36. Which of the following was not an objective of the algorithm performance evaluation studies?
- Increased scan speed
 - Noise reduction
 - Image quality improvement
 - Artifact reduction

Chapter 7

37. A method of fetching and decoding instruction is the definition for what?
- Multitasking
 - Parallel processing
 - Multiprocessing
 - Pipelining
38. To process and reconstruct data, the computer receives the digital data from where?
- Data acquisition system
 - Image display
 - Software
 - Programs
39. What is the typical power ratings range for generators?
- 20 to 50 kW
 - 30 to 60 kW
 - 40 to 70 kW
 - 50 to 80 kW
40. Which of the following **in not** one of the four main classes of a computer?
- Superconductors
 - Mainframe computers
 - Low range computers
 - Microcomputers

41. How much storage is needed for a 50 image CT scan?
- a. 10 MB
 - b. 15 MB
 - c. 20 MB
 - d. 25 MB
42. What is the simplest and most reliable gas laser?
- a. Helium
 - b. Argon
 - c. Carbon dioxide
 - d. Helium-neon
43. HL-7 is the standard communication protocols for what system?
- a. DICOM
 - b. HIS
 - c. RIS
 - d. B & C

Chapter 8

44. Window width is the center or midpoint of the range of CT numbers.
- a. True
 - b. False
45. What window width should be used to display a brain image?
- a. 60 HU to 130 HU
 - b. 70 HU to 140 HU
 - c. 80 HU to 150 HU
 - d. 90 HU to 160 HU
46. What image is defined as a plane that cuts through the coronal and sagittal planes?
- a. Sagittal image
 - b. Oblique image
 - c. Coronal image
 - d. Paraxial image
47. Which of the following **is not** a class of 3D imaging operations?
- a. Preprocessing
 - b. Postprocessing
 - c. Visualization
 - d. Analysis
48. What advanced tool allows the users to view a large set of images very quickly?
- a. Virtual reality tool
 - b. Image fusion tool
 - c. Cine visualization tool
 - d. Interactive visualization tool
49. A workstation monitor should have at least what pixel resolution?
- a. 1.5 K × 1.5 K
 - b. 2.0 K × 2.0 K
 - c. 2.5 K × 2.0 K
 - d. 3.0 K × 3.0 K

Chapter 9

50. In-plane resolution is specified in terms of what line pair?
- Line pairs per millimeter
 - Line pairs per centimeter
 - Line pairs per meter
 - A & B
51. Which of the following **is not** a dominating factor affecting in-plane spatial resolution?
- Focal spot size
 - Detector cell size
 - Scanner speed
 - Sampling frequency
52. A key advantage of CT over conventional radiography is its ability to observe low-contrast objects.
- True
 - False
53. What is an indication of a CT systems ability to freeze motion of the scanned object?
- Filtered back-projection
 - Temporal resolution
 - Contrast resolution
 - Sensitivity
54. What is the most straightforward way to reduce or eliminate cardiac motion?
- Increase cardiac gating
 - Increase scan speed
 - Increase tube voltage
 - Decrease slice thickness
55. Third generation scanners are capable of rotating at speeds of less than _____ per gantry rotation.
- .2 seconds
 - .3 seconds
 - .4 seconds
 - .5 seconds
56. Which of the following **is not** a major contributor to the noise of an image?
- Quantum noise
 - Physical limitations of the system
 - Reconstruction parameters
 - Linear attenuation
57. What type artifact appears as an intense straight line across an image?
- Shading
 - Ring
 - Band
 - Streak
58. What should the technologist do to reduce streak artifacts?
- Optimize the patient positioning
 - Optimize scan speed
 - Optimize exposure technique
 - All the above

Chapter 10

59. One rad is equal to ____ Gy.
- 0.0001 Gy
 - 0.001 Gy
 - 0.01 Gy
 - 0.1 Gy
60. What is the dose limit for radiation workers?
- 10 mSv per year
 - 15 mSv per year
 - 20 mSv per year
 - 25 mSv per year
61. The ionization chamber method of measuring dose is the easiest and most accurate.
- True
 - False
62. Which metric is displayed on the CT scanner console?
- Effective dose
 - Dose index
 - Dose-length product
 - B & C
63. What is a radiation protection principle intended to ensure the dose is kept as low as reasonably achievable?
- Dose reduction
 - Dose compromise
 - Dose effectiveness
 - Dose optimization
64. Which of the following is a radiation protection action used to protect patients and personnel?
- Shielding
 - Distance
 - Time
 - All the above

Chapter 11

65. What is the table speed during a 1 second scan?
- 5 mm/s
 - 10 mm/s
 - 15 mm/s
 - 20 mm/s
66. What was the first interpolation algorithm used during the initial development of spiral/helical CT scanners?
- 60 – degree LI algorithm
 - 90 – degree LI algorithm
 - 180 – degree LI algorithm
 - 360 – degree LI algorithm

67. One of the most conspicuous differences between MSCT and SSCT is MSCT uses a single row of detectors.
- True
 - False
68. In subsecond scanners the x-ray tube applies the potential difference equally so the cathode can be 75 kV while the anode is at _____.
- 60 kV
 - 65 kV
 - 70 kV
 - 75 kV
69. A collimator width of 8 mm falling on an ID detector array will provide a slice thickness of _____.
- 4 mm
 - 6 mm
 - 8 mm
 - 16 mm
70. What is the distance between the turns on a fastener called?
- Beam geometry
 - Slice thickness
 - Pitch
 - Collimator
71. What is one of the major goals of isotropic imaging in CT?
- Increased number of slices
 - Excellent spatial resolution
 - Decreased scan time
 - Reduced dose

Chapter 12

72. Which calculation is used to determine table speed?
- $d = R/T$
 - $d = T/R$
 - $d = S \times P/t$
 - A & C
73. What is the first visualization tool for use in CTA?
- Multiplanar reconstruction
 - Collimation
 - Temporal resolution
 - Image fusion
74. Maximum intensity projection is used to display what structure?
- Bone
 - Tissue
 - Vessels
 - A & B

75. What year was the first CT scanner capable of real-time imaging introduced in North America?
- 1992
 - 1994
 - 1996
 - 1998
76. Which company produces real-time CT fluoroscopy CT scanners?
- Toshiba
 - G.E.
 - Siemens
 - All the above
77. What solution was developed to reduce the radiation dose to hands during a CT fluoroscopy?
- Decreased scan time
 - Special protective gloves
 - Extension clamp
 - Needle holders
78. Quantitative CT **is not** the most sensitive x-ray technique to measure the mineral content of trabecular bone.
- True
 - False

Chapter 13

79. In medicine 3D imaging uses a right handed _____, _____ and _____ coordinate system.
- a, b, c
 - r, s, t
 - u, v, w
 - x, y, z
80. What is the generation of a 3D object using computer software called?
- Manipulation
 - Visualization
 - Modeling
 - Rendering
81. What is the computer program that converts the anatomic data into the 3D image?
- Ray tracing
 - Contouring
 - Shading
 - Rendering
82. What is the most popular 3D imaging approach?
- Volume imaging
 - Projective imaging
 - Slice imaging
 - Coordinate imaging

83. How many steps are needed to create 3D images?
- a. 4
 - b. 5
 - c. 6
 - d. 7
84. What is another name for shaded surface display?
- a. Volume rendering
 - b. Surface rendering
 - c. Intensity projection rendering
 - d. Semicircle rendering
85. Volume rendering offers the advantage of viewing both internal and external structures.
- a. True
 - b. False
86. What is the most popular rendering technique in CTA and MRA?
- a. Average intensity projection (AIF)
 - b. Maximum intensity projection (MIP)
 - c. Minimum intensity projection (MinIP)
 - d. Weighted intensity projection (WIP)

Chapter 14

87. How many detectors may be in a single PET ring?
- a. 300 to 500
 - b. 400 to 600
 - c. 500 to 700
 - d. 600 to 899
88. What is the advantage of SPECT over PET?
- a. Radiopharmaceuticals routinely used in nuclear medicine can be used in SPECT
 - b. High sensitivity
 - c. Better quantitative accuracy
 - d. High spatial resolution
89. What is the FDG uptake waiting period to image the brain?
- a. 20 to 30 minutes
 - b. 30 to 40 minutes
 - c. 40 to 60 minutes
 - d. 60 to 75 minutes
90. What is the typical effective dose range for a helical CT of the chest and abdomen/pelvis?
- a. 1 to 2 mSv
 - b. 3 to 5 mSv
 - c. 7 to 10 mSv
 - d. 10 to 15 mSv

91. What radiopharmaceutical is used for brain perfusion imaging with SPECT?
- Exametazime
 - Ethyl cysteinate dimer
 - FDG
 - A & B
92. What is one of the most common radiotracer formulations for lymphoscintigraphy?
- Carbon
 - Nitrogen
 - Sulfur colloid
 - Oxygen

Chapter 15

93. Early edema from a cerebral infarct causes an increase of gray-white matter differentiation.
- True
 - False
94. What is a normal score on the Glasgow Coma Scale?
- 9
 - 12
 - 14
 - 15
95. What is the most common brain tumor?
- Meningioma
 - Metastasis
 - Astrocytoma
 - Glioblastoma
96. What scan can be done last when imaging a multiple trauma patient?
- Non-contrast head CT
 - Thoracic aorta CTA
 - Chest, abdomen and pelvis CT
 - CTA of the neck vessels
97. Coronal images are valuable to evaluate which of the following?
- Floor and roof of the orbit
 - Base of the skull
 - Top of the cranial vault
 - All the above
98. What is the most used plane to image the skull and its contents?
- Frontal
 - Transverse
 - Coronal
 - Sagittal

99. After injecting contrast media using the IV drip method, how much time does it take to reach satisfactory enhancement to image the brain and spine?
- 1 to 2 minutes
 - 2 to 3 minutes
 - 3 to 5 minutes
 - 5 to 7 minutes

Chapter 16

100. CT is the most sensitive technique for detecting what kind of metastasis?
- Liver
 - Pulmonary
 - Colon
 - Pancreas
101. Helical CT is not as sensitive as ventilation/perfusion scans in detecting pulmonary emboli.
- True
 - False
102. What is the most effective way to image patients after blunt chest trauma?
- Multislice CT
 - Radiography
 - MRI
 - Ultrasound
103. What is the most commonly injured solid organ in the abdomen?
- Kidney
 - Liver
 - Pancreas
 - Spleen
104. Patients with compromised renal function have a _____ greater risk of developing contrast-induced nephropathy.
- Three times
 - Four times
 - Five times
 - Six times

Chapter 17

105. What is one inherent disadvantage with MDCT scanning when acquiring submillimeter slices?
- Patient movement
 - Longer reconstruction time
 - Decreased resolution
 - Increased radiation dose
106. It is important to maintain a neonatal patient's _____ during the scan.
- Respiratory rate
 - Blood pressure
 - Oxygen level
 - Body temperature

107. Scan times are short as _____ decreases the need for sedation.
- 2 to 4 seconds
 - 3 to 6 seconds
 - 5 to 10 seconds
 - 12 to 15 seconds
108. Which exam is an example of a scan requiring sedation?
- Temporal bone
 - CTA
 - Brain
 - A & B
109. Compared to a pitch of 1, a pitch of 2 can reduce exposure by what percentage?
- 20%
 - 30%
 - 40%
 - 50%
110. In children, what is the primary imaging modality for the abdomen and pelvis?
- CT
 - MRI
 - Ultrasound
 - Radiography
111. What is the most common infection in children where CT is used?
- Pneumonia
 - Pyelonephritis
 - Appendicitis
 - All the above
112. What is essential to obtain a motion free high-quality CTA?
- Proper immobilization
 - Low effective dose
 - Optimum protocol
 - Proper positioning

Chapter 18

113. What program is designed to periodically test performance of the CT scanner?
- Preventative maintenance
 - Quality assurance
 - Quality control
 - Performance improvement
114. Which of the following **is not** a fundamental step in a QC program?
- Acceptance testing
 - Patient protocols
 - Routine performance evaluation
 - Error correction

115. Routine performance evaluation refers to monitoring the components of the CT scanner that affect dose and image quality.
- True
 - False
116. What is the ACR accreditation phantom based on?
- Solid water construction
 - Solid gel construction
 - Solid water/gel construction
 - Solid crystal construction
117. The ACR phantom consists of how many modules?
- Three
 - Four
 - Five
 - Six
118. Which of the following **is not** a basic tenet of CT quality control?
- Performed by a trained technologist
 - Performed on a regular basis
 - Prompt interpretation of the measurements
 - Faithful bookkeeping
119. What test limit indicates the performance must be within certain tolerances or the equipment should not be used?
- Achievable level
 - Acceptable level
 - Visual inspection
 - Uniformity inspection
120. How often does the ACR require CT technologists to identify and correct image artifacts from a water phantom?
- Daily
 - Weekly
 - Monthly
 - Annually