Digital Image Manipulation

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. The pixel bit depth determines the image's:
a. Brightness
b. Contrast
c. Spatial resolution
d. Contrast resolution

____ 2. The distracting area of increased brightness surrounding a collimated image can be removed from the displayed digital image by:
a. Masking
b. Shuttering
c. Electronic collimation
d. All of the above

____ 3. Decreasing the window level will result in an image with:
a. Lower contrast
b. Higher contrast
c. Decreased brightness
d. Increased brightness

____ 4. Increasing the window width will result in an image with:
a. Lower contrast
b. Higher contrast
c. Decreased brightness
d. Increased brightness

____ 5. This postprocessing technique improves the visibility of small, high contrast structures.
a. Smoothing
b. Contrast enhancement
c. Edge enhancement (sharpening)
d. Subtraction

____ 6. The combination of rows and columns that make up the digital image is the:
a. matrix
b. FOV
c. pixel
d. bit depth

____ 7. The smallest component of the digital image matrix is the:
a. matrix
b. FOV
c. pixel
d. bit depth

____ 8. The anatomic area being imaged is the:
a. matrix
b. FOV

c. pixel
d. bit depth

____ 9. The number of bits that determine the gray level that can be assigned to a pixel is the:
a. matrix
b. FOV
c. pixel
d. bit depth

____ 10. How many pixels does a 600 × 600 matrix have?
a. 600
b. 1200
c. 3600
d. 360,000

____ 11. Which of the following matrices results in a digital image with the best image quality?
a. 200 × 200
b. 600 × 600
c. 1024 × 1024
d. 2048 × 2048

____ 12. The numerical value assigned to each pixel is based on:
a. the size of the matrix
b. the relative attenuation of x-rays transmitted through the part
c. the FOV
d. all of the above

____ 13. The advantage of having a larger bit depth is that:
a. a larger part can be imaged
b. more shades of gray can be assigned to the pixel
c. the image has improved contrast resolution (more shades of gray)
d. B and C

____ 14. The amount of light emitted from the display monitor is:
a. brightness
b. contrast resolution
c. spatial resolution
d. noise

____ 15. The range of shades visible on the digital image is determined by:
a. window level
b. window width
c. windowing
d. all of the above

____ 16. In digital imaging, spatial resolution is ultimately limited by _____.
a. focal spot size
b. spatial frequency
c. contrast resolution

d. pixel size

____ 17. Image detail is also called _____.
a. spatial resolution
b. spatial frequency
c. signal to noise ratio
d. dynamic range

____ 18. Which of the following matrix sizes will produce the best spatial resolution?
a. 500 × 1,000 matrix
b. 1,000 × 1,000 matrix
c. 2,000 × 2,000 matrix
d. 3,000 × 3,000 matrix

____ 19. The greatest spatial resolution will be produced when the matrix is _____ and the pixels are _____.
a. small; large
b. small; small
c. large; small
d. large; large

____ 20. A matrix of 1200 × 1800 will show how many pixels on the viewing monitor?
a. 2,160,000
b. 2,800,000
c. 4,160,000
d. 4,160,000

____ 21. The number of gray shades that a digital system can reproduce is termed:
a. quantum mottle.
b. dynamic range.
c. contrast resolution.
d. spatial resolution.

____ 22. "Noise" refers to the amount of information that is not useful in the radiographic image. This noise is referred to as:
a. quantum mottle.
b. shuttering.
c. dynamic range.
d. signal-to-noise ratio (SNR).

____ 23. Which control on the viewing station controls the brightness, in the radiographic image?
a. Window width
b. Window level
c. Shuttering
d. Dynamic range

____ 24. "Window width" controls which aspect of the radiographic image?
a. Shuttering
b. Noise
c. Density

d. Contrast

____ 25. Which control on the viewing station can blacken the clear or white areas around the collimation edges of a radiograph?
a. Shuttering
b. Image stitching
c. Window width
d. Window level

____ 26. What is the name of the computer software function that allows separate radiographic images to be tied into one image for viewing?
a. Shuttering
b. Image stitching
c. Window level
d. Window width

____ 27. Which of the following should never be placed on the radiographic image using electronic means (computer software)?
a. Diagnosis
b. Patient's age
c. Patient's name
d. R and L markers

____ 28. The computer software function that allows any type of "text" to be written on a radiographic image is:
a. window width.
b. window level.
c. image annotation.
d. image stitching.

____ 29. What is the name of the processing technique that can be used to increase contrast and sharpen the image?
a. Contrast resolution
b. DICOM gray-scale function
c. Edge enhancement
d. Image annotation

____ 30. The universally accepted standard for exchanging radiographic images inside and outside the institution, and among all manufacturers, is which of the following?
a. DICOM
b. Health level-7
c. DICOM gray-scale function
d. ALARA

____ 31. Which radiographic examination would require "image stitching" of several separate images?
a. The leg
b. All femur radiographs
c. Full-spine for scoliosis
d. Abdomens on patients taller than 6 feet

____ 32. What artifact will be shown in the radiographic image if there is inadequate exposure technique?
a. Quantum mottle
b. Moire pattern
c. Ghost images
d. Light spots

True/False
Indicate whether the statement is true or false.

____ 1. Windowing does not alter the original stored pixel values.
A. True
B. False

Digital Image Manipulation
Answer Section

MULTIPLE CHOICE

1. ANS: D
   Contrast resolution is determined by the pixel bit depth. The greater the pixel bit depth, the more shades of gray to be used.

   PTS: 1 OBJ: 4
2. ANS: D
   Masking, shuttering, and electronic collimation are all terms that describe the ability to limit the area of an image to be viewed.

   PTS: 1 OBJ: 4
3. ANS: C
   A lower window level results in an image with decreased brightness.

   PTS: 1 OBJ: 6
4. ANS: A
   Increasing window width results in a digital image with lower contrast.

   PTS: 1 OBJ: 6
5. ANS: C
   Edge enhancement makes structures more visible.

   PTS: 1 OBJ: 6
6. ANS: A
   The matrix is the combination of rows and columns that make up the digital image.

   PTS: 1 OBJ: 13
7. ANS: C
   The pixel, or picture element, is the smallest component of the image matrix.

   PTS: 1 OBJ: 13
8. ANS: B
   The field of view (FOV) is the anatomic area being imaged.

   PTS: 1 OBJ: 13
9. ANS: D
   The bit depth is the number of bits used to determine the gray level assigned to a pixel.

   PTS: 1 OBJ: 15
10. ANS: D
    A 600×600 matrix has 600 multiplied by 600 pixels.

    PTS: 1 OBJ: 13

11. ANS: D
For a given FOV, the larger the matrix, the smaller the pixels resulting in the best image quality.

PTS: 1 OBJ: 13

12. ANS: B
The relative attenuation of x-rays transmitted through the part determines the number assigned to each pixel.

PTS: 1 OBJ: 13

13. ANS: D
Larger bit depth results in more shades of gray being available to assign to a pixel, improving contrast resolution.

PTS: 1 OBJ: 15

14. ANS: A
Brightness is the amount of light emitted from the display monitor.

PTS: 1 OBJ: 16

15. ANS: D
Windowing, including setting the window width and level, allows adjustment of the range of shades visible on the digital image.

PTS: 1 OBJ: 17

16. ANS: D
A digital imaging system cannot resolve anything smaller than one pixel.

PTS: 1 DIF: Difficult REF: page 308
OBJ: Understand and describe the concept of spatial resolution.

17. ANS: A
Image detail is also called spatial resolution.

PTS: 1 DIF: Moderate REF: page 312 OBJ: Define spatial resolution.

18. ANS: D PTS: 1 REF: Page 96
19. ANS: C PTS: 1 REF: Page 96
20. ANS: A PTS: 1 REF: Page 96
21. ANS: B PTS: 1 REF: Page 96
22. ANS: A PTS: 1 REF: Page 96
23. ANS: B PTS: 1 REF: Page 96
24. ANS: D PTS: 1 REF: Page 96
25. ANS: A PTS: 1 REF: Page 96
26. ANS: B PTS: 1 REF: Page 97
27. ANS: D PTS: 1 REF: Page 98
28. ANS: C PTS: 1 REF: Page 97
29. ANS: C PTS: 1 REF: Page 98
30. ANS: A PTS: 1 REF: Page 101
31. ANS: C PTS: 1 REF: Page 97
32. ANS: A PTS: 1 REF: Page 99

TRUE/FALSE

1. ANS: T
   The original pixel values remain unchanged following adjustments of window level and width.

   PTS: 1 OBJ: 1