# Chapter 31

1. A high window level will result in which of the following on the displayed digital image?

a. High contrast

b. Long gray scale

c. Bright image

d. Dark image

2. To demonstrate soft tissue structures on a digital image, which of the following windowing

combinations is best:

a. high window width, high window level

b. low window width, high window level

c. high window width, low window level

d. low window width, low window level

3. Some manufacturers use a logarithmic scale for the exposure indicator, with an ideal

index number of 2000. If a radiograph is produced with an exposure index of 2300, what

change in radiographic technique would bring it back to the ideal amount?

a. Reduce to one-half

b. Double

c. Reduce to one-third

d. Triple

e. Reduce mAs by 300

4. For all manufacturers, the acceptable range of exposure indicator values is determined by the

original x-ray exposure falling within what range of the “ideal exposure level:

a. plus or minus 15%

b. plus or minus 50%

c. one-half to double

d. one-quarter to 4 times

5. For all digital imaging systems, a lower limit for exposure to the receptor is imposed by:

a. the appearance of quantum mottle

b. images turning out too light

c. the appearance of fog density

d. images turning out with excessive contrast

6. On most digital systems, image brightness can be increased by:

a. holding the mouse button down and moving the cursor to the right

b. holding the mouse button down and moving the cursor downward

c. sliding the “gamma” tab up or to the right

d. moving the cursor up while holding it over the histogram

7. Which of the following is it recommended to make a permanent record of for each image:

a. the histogram

b. the exposure indicator

c. the initial contrast level

d. the initial brightness level

8. How is the “speed” of a CR system determined?

a. One speed class is built into the equipment when it is manufactured

b. It depends on which cassette is used

c. It depends on the radiographic technique selected

d. Department management and QC technologists decide what it will be upon installation

9. Mottle is likely to appear in the computerized image any time the:

a. brightness is very low

b. contrast is very low

c. exposure indicator is very low

d. density is very low

10. The normal acceptable range of exposure readings is from 100 to 400 for which brand:

a. Fuji

b. CareStream

c. Agfa

d. Phillips

11. Which manufacturer uses the *S-Number* to adjust brightness in the image?

a. General Electric

b. Agfa

c. CareStream

d. Fuji

12. Which manufacturer refers to its exposure indicator as the *exposure index*?

a. Fuji

b. CareStream

c. Agfa

d. General Electric

13. Anything that can result in a histogram error can result in:

a. improper technique

b. mottle

c. blank image

d. exposure indicator error

14. The use of post-cropping features and electronically inserted right or left markers:

a. has legal ramifications

b. is no substitute for collimation of the x-ray beam and lead markers during exposure

c. may be interpreted as an attempt to hide poor clinical practice

d. all of the above

15. For a radiograph, image reversal:

a. produces a white-on-black image

b. presents only subjective visual changes to the image

c. presents more actual information in the image

d. flips the image left-for-right

16. Which of the following features suppresses image noise (mottle) with an attendant slight decrease in contrast throughout the image?

a. image stitching

b. windowing

c. smoothing

d. image reversal or “black bone”

17. Which of the following is a possible ill effect of edge enhancement?

a. excessive noise

b. segmentation failure

c. saturation

d. excessive overall brightness

18. For a scoliosis series, which of the following is needed with digital equipment:

a. Dual-energy subtraction

b. Dark masking

c. Image reversal

d. Image stitching

19. Which of the following is determined by the computer by finding the mid-point between

SMIN and SMAX in the main lobe of the generated histogram for the image?

a. the exposure indicator

b. the average gray scale

c. the dynamic range

d. the volume of interest

20. For systems using an inverted scale for their exposure index, a high original “S” number

indicates:

a. too low original exposure

b. too high original exposure

c. too low displayed image brightness

d. too high displayed image brightness

21. Mottle in a CR or DR image can result from:

a. insufficient kVp

b. insufficient mAs

c. improperly calibrated AEC

d. all of the above

e. none of the above

22. For the Fuji CR system, changing the “L” number adjusts the:

a. indication of original exposure

b. brightness of the displayed image

c. contrast of the displayed image

d. window level

23. For a quality digital image, the highest possible \_\_\_\_\_\_\_ should be achieved:

a. brightness

b. contrast

c. gray scale

d. signal-to-noise ratio

e. magnification

24. For most CR systems, dragging the cursor *vertically* on the display screen can be used to

adjust the displayed image:

a. magnification

b. sharpness

c. contrast

d. brightness

25. The exposure indicator is \_\_\_\_\_\_\_\_\_ related to the brightness of the image displayed on the

monitor screen:

a. directly

b. inversely

c. exponentially

d. not

26. The standardized exposure indicator recommended by the AAPM in 2009 is based on actual

exposure to the image detector measured in:

1. Roentgen
2. C/kg
3. Kerma in microgray
4. Sievert

27. For each image in the PACS, the exposure indicator or deviation index is to be permanently

stored as part of the DICOM:

1. Header
2. Tag
3. Menu
4. Viewer

28. Which of the following is to be prominently displayed immediately after every exposure to

indicate how far off the radiographic technique was from an ideal exposure level:

1. Exposure index
2. Target EI
3. Deviation index
4. Air kerma

29. The deviation index changes by minus one (-1.0) for each exposure reduction of:

a. 15%

b. 20%

c. 25%

d. 50%

30. For increasing exposure, the step changes for the deviation index are *multiplicative.* For

overexposure, each step increase multiplies the previous amount by:

1. 0..794
2. 1.259
3. 75%
4. 80%

31. A deviation index of -3 indicates an under-exposure of \_\_\_\_\_ the ideal level:

a. 3 times

b. 0.7 times

c. 1/2

d. 1/3

32. Only exposures with a deviation index of \_\_\_\_\_\_ should be *assumed* to be repeatable:

a. greater than +3

b. greater than +2

c. less than -2

d. less than -3

33. No *overexposed* digital image should ever be repeated, no matter the EI, unless \_\_\_\_\_\_ has

occurred:

1. Image reversal
2. Low contrast
3. Mottle
4. Fogging
5. Saturation

34. Even with the most sensitive digital imaging systems, true saturation requires at least \_\_\_\_\_

times the normal exposure to occur:

a. 2

b. 4

c. 6

d. 10

e. 20

35. When an alternate algorithm has been used to successfully improve an image, the best

follow-up for PACS storage is to:

1. Save the original, discard the copy after showing it to the radiologist
2. Replace the original with the copy
3. Save both the original and the copy as separate files
4. Print the original, save the copy

36. *Display* magnification of a digital image is controlled by all of the following *except:*

a. display screen size

b. matrix size

c. field of view

d. SID/OID ratio

37. When windowing the displayed image, extreme reduction of contrast may \_\_\_\_\_\_\_ the

image:

1. Fog
2. Lighten
3. Erase
4. Reverse

38. The speed of a digital imaging system is \_\_\_\_\_ to the amount of exposure required to

produce adequate signal for processing:

1. Not related
2. Directly proportional
3. Inversely related
4. Exponentially related

39. Nearly all modern CR and DR systems can be operated at a \_\_\_\_\_\_\_\_ of 350 or 400 without

the appearance of substantial mottle in the image.

1. exposure indicator
2. speed class
3. deviation index
4. exposure time

40. When edge enhancement is applied to an image that already possesses high contrast, an

artifact may be caused in which the dark and light sides of edges are exaggerated. This

artifact is called:

1. Aliasing
2. Moire effect
3. Dark masking
4. Halo effect

41. For GE’s *look* feature, a “hard”, “normal”, or “soft” look can be applied to the image. The

*soft* look actually applies a \_\_\_\_\_\_\_ algorithm:

1. Rescaling
2. Smoothing
3. Edge enhancement
4. Background suppression

42. Default settings for smoothing and edge enhancement features:

a. cannot be changed from the manufacturer’s settings

b. can be changed by staff radiographers without a password

c. can be excessive enough to cause misdiagnosis

d. are always at an ideal level for diagnostic purposes

43. True saturation presents an area of the image with:

a. lightened density

b. darkened density

c. no details at all present

d. excessive contrast

44. Which of the following features would be generally recommended for *all* images

being viewed:

1. Black masking
2. Image reversal
3. Resizing
4. Image stitching

45. To brighten *everything* in an image, use:

a. Tissue impression

b. Equalization

c. Window level

d. Window width

46. True saturation is a phenomenon that occurs:

a. at the electronic DR detector plate

b. from computer processing

c. during analog-to-digital conversion (at the ADC)

d. in the display monitor

47. Leveling (adjusting the window level) is a readjustment to the \_\_\_\_\_\_\_\_\_\_\_ already applied

during default:

1. Values (volume) of interest
2. Dynamic range compression
3. Gradation LUTs
4. Rescaling

48. The *bone or tissue impression* feature selects a specific portion of the \_\_\_\_\_\_\_ to enhance:

a. histogram

b. values of interest (VOI)

c. image area

d. frequency range

49. Edge enhancement, smoothing, and noise reduction, are all adjustments to the \_\_\_\_\_\_\_\_\_\_

settings already applied during default processing:

1. Rescaling
2. Dynamic range
3. Local contrast
4. Global contrast

50. *Window center, amplification, S value, S shift,* and *window level* are all manufacturer terms

for adjustments to image \_\_\_\_\_\_\_\_\_\_.

1. Brightness
2. Global contrast
3. Local contrast
4. Dynamic range

51. *Window, latitude, C shift,* and *G value* are all manufacturer terms for adjustments to image

\_\_\_\_\_\_\_\_\_\_\_:

1. Brightness
2. Global contrast
3. Local contrast
4. Bit depth

52. *Soft look, HS processing, negative edge enhancement,* and *local contrast limiter* are all

manufacturer terms for \_\_\_\_\_\_\_\_\_\_\_\_\_.

1. Equalization
2. Smoothing
3. Tissue impression
4. Edge enhancement

53. *Contrast balance, latitude reduction, E processing,* and *dynamic range control* are all

manufacturer terms for \_\_\_\_\_\_\_\_\_\_\_\_.

1. Equalization
2. Smoothing
3. Tissue impression
4. Edge enhancement

54. Three manufacturers have an operator adjustment feature for “sharpness.” This is actually an

adjustment to:

1. Brightness
2. Global contrast
3. Local contrast
4. Dynamic range

55. *Background suppression* is a subtractive approach to:

a. Equalization

b. Smoothing

c. Edge enhancement

d. Tissue impression

56. To better demonstrate the thin trabecular markings within the marrow of a bone, use:

a. Equalization

b. Smoothing

c. Edge enhancement

d. Tissue impression

57. On an AP projection of the thoracic spine, if the cervicothoracic vertebrae are too dark and

*also* the thoracolumbar vertebrae are too light, use:

a. Equalization

b. Smoothing

c. Edge enhancement

d. Background suppression

58. The *sensitivity* of any imaging system to x-ray exposure is expressed by its:

* 1. Exposure indicator
  2. Deviation index
  3. Speed
  4. MTF

59. The speed of a digital imaging system is impacted by all of the following EXCEPT:

a. Digital processing

b. The inherent speed of the image receptor

c. The radiographic technique used for a particular procedure

d. It is impacted by all of these

1. Nearly all modern CR and DR systems can be operated at a \_\_\_\_\_\_\_\_ of 350 or 400 without the appearance of substantial mottle in the image.
   1. exposure indicator
   2. speed class
   3. deviation index
   4. exposure time
2. Although early CR readers were typically installed to operate at a 200 speed class, setting CR and DR systems to operate at a 400 speed class saves:
   1. Money
   2. Patient dose
   3. Time
   4. Equipment wear
3. For digital imaging equipment, the final displayed image will generally:
   1. Be reliably darker when more mAs was used
   2. Be reliably darker when more kVp was used
   3. Be reliably grayer when more kVp was used
   4. Give no indication if excessive technique was used
4. The exposure indicator is:
   1. A direct measurement of patient dose
   2. An indirect indicator of patient dose
   3. Completely unrelated to patient dose
5. For a particular digital imaging system, the ideal amount of exposure desired at the IR is expressed as the:
   1. EI
   2. EIT
   3. DI
   4. Average density
6. Exposure indicators come in the form of all the following EXCEPT:
   1. Directly proportional scales
   2. Inversely proportional scales
   3. Logarithmic scales
   4. Direct x-ray measurements
7. Expressed as *ratios,* the “target” range of exposures is from \_\_\_ to \_\_\_ the ideal

exposure:

a. 90% to 110%

b. 3/4 to 4/3

c. 4/5 to 5/4

d. 1/2 to 3/2

1. An exposure less than 80% of the EIT should:

a. be repeated

b. not be repeated

c. not be repeated unless a radiologist finds unacceptable mottle

d. be repeated unless a radiologist finds unacceptable mottle

1. The reason the deviation index table urges “no repeat” for images that are simply too

dark is because they:

1. Can generally be corrected by windowing
2. Cannot be corrected
3. Can be diagnosed without any correction
4. Are always corrected automatically by digital processing
5. Saturation is best described as:

a. gross underexposure

b. overexposure

c. excessive fog

d. loss of data

1. The deviation index (DI) provides:

a. assurance that the correct radiograph technique was set at the console

b. a measurement of patient dose

c. the main indicator of image quality

d. none of the above

1. Dark masking, operator leveling and windowing, and application of alternate algorithms are all examples of:
   1. Processing
   2. Postprocessing
   3. Preprocessing
   4. Spatial processing
2. The use of *alternate* processing algorithms should be:
   1. Never considered
   2. Applied to all procedures
   3. Used and saved according to the individual radiographer’s discretion
   4. The exception, not the rule
3. If the original image is re-processed using an alternate algorithm, and then saved into the PACS, it is recorded in the system’s metadata as:
   1. A different procedure
   2. An image added to the procedure
   3. An altered copy of the original
   4. The original
4. There is nothing wrong with radiographers:
   1. making adjustments to images as they view them
   2. saving permanent changes to the original displayed image
   3. erasing imperfect images while the patient remains in position for a repeat
   4. using high mAs to ensure that mottle never appears
5. Increasing the contrast brings the:
   1. Window width number down
   2. Window width number up
   3. Window level number down
   4. Window level number up
6. Generally, when the window level is raised, the range of gray scale is:
   1. Increased
   2. Decreased
   3. Unchanged
   4. Irrelevant
7. In a digital image, which of the following is synonymous with the *length* ofthe gray scale:
   1. Brightness
   2. Contrast
   3. Window level
   4. Window width
8. For digital systems using the term “contrast”, this numerical indicator would be:
   1. Synonymous with window level
   2. Synonymous with window width
   3. Opposite to window level
   4. Opposite to window width
9. For digital equipment, an increase in image contrast is accompanied by:
   1. An increase in brightness
   2. A decrease in brightness
   3. An increase in gray scale
   4. None of the above
10. Original digital image data should always be:
    1. Corrected before diagnosis
    2. Saved as is for diagnosis
    3. Corrected before saving to the PACS
11. Which of the following postprocessing features is used to eliminate extreme densities from the grayscale of the displayed image, both extremely light or extremely dark densities:
    1. Tissue impression
    2. Equalization
    3. Smoothing
    4. Background suppression
12. At a glance, equalization makes a displayed image appear generally more:
    1. Dark
    2. Light
    3. Gray
    4. Contrasty
13. Which of the following is a true statement:
    1. Increasing global contrast will include increased local contrast
    2. Increasing local contrast will include increased global contrast
    3. Increasing window level will always include increased contrast
    4. Increasing window width will always include increased brightness
14. Any postprocessing operation that reduces local contrast will also:
    1. Increase noise
    2. Reduce noise
    3. Reduce brightness
    4. Reduce global contrast
15. The use of smoothing will tend to:

a. increase the sharpness of the edges of the image border

b. improve the alignment of images during subtraction

c. eliminate the appearance of severe noise when little data is available

d. suppress the appearance of high-attenuation artifacts from the image

1. The trade-off for smoothing, especially if the image already possesses low contrast, is a:
   1. Loss of some diagnostic details
   2. Loss of gray scale
   3. Increased fog
   4. Increased noise
2. The trade-off for edge enhancement, even when properly applied, is a slightly more \_\_\_\_\_\_ image:
   1. Gray
   2. Blurry
   3. Fogged
   4. Noisy
3. Although changing local contrast has no effect on global (overall) image contrast, increasing overall contrast *does* affect local contrast because small details are:
   1. Included in the operation
   2. Eliminated
   3. Suppressed
   4. Sharpened
4. Smoothing algorithms *cannot* help correct for:
   1. Excessive local contrast
   2. Dead pixels
   3. Moderate noise
   4. Severe mottle
5. Smoothing algorithms *cannot:* 
   1. Make the image more visually appealing
   2. Reduce local contrast
   3. Correct for stuck pixels
   4. Recover missing information due to underexposure
6. By applying edge enhancement, small pathological changes, such as a “hairline” fracture, may become more:
   1. Visible
   2. Sharp
   3. Magnified
   4. Distorted
7. Loss of detail can occur from:
   1. Over-application of smoothing
   2. Over-application of edge enhancement
   3. Both of the above
   4. Neither of the above
8. Manufacturers’ default settings for edge enhancement and smoothing:
   1. Can and should be customized by the QC technologist and radiologists
   2. Can, but should not, be customized by any user
   3. Cannot be customized by users
   4. Cannot be customized by anyone after the machine is manufactured
9. *Background suppression* algorithms reduce the contrast only of:
   1. The pitch-black background density from “raw” x-ray exposure
   2. Large- to mid-size structures in the image
   3. Mid-size to small structures in the image
   4. Very fine details in the image
10. GE’s *underpenetrated* feature:
    1. Increases x-ray beam penetration
    2. Decreases x-ray beam penetration
    3. Darkens a specified region of interest in the image
    4. Lightens a specified region of interest in the image
11. Which of the following features would be generally recommended for *all* images

being viewed:

1. Dark masking
2. Image reversal
3. Resizing
4. Image stitching
5. Dark masking reduces extraneous glare, improving the apparent \_\_\_\_\_\_\_\_ of the displayed image:
   1. Sharpness
   2. Contrast
   3. Magnification
   4. Noise
6. Legally, dark masking should be used to “re-collimate” an image taken with too large an x-ray exposure area:
   1. Always
   2. Never
   3. At the technologist’s discretion
   4. At the radiologist’s discretion
7. Radiologists are legally responsible for \_\_\_\_\_\_ diagnostic information on the original radiograph:
   1. All related to the ordered procedure
   2. All related to the centered anatomy
   3. All included in the “post-collimated” image
   4. All
8. From a selected mid-point in the various gray levels of a digital image, lighter

areas in the image are progressively darkened, while darker areas are

progressively lightened. This describes:

a. multiscale processing

b. normalization

c. dynamic range compression

d. rescaling of brightness

e. flat-field uniformity correction

1. *Background suppression* refers to elimination of the very \_\_\_\_\_\_\_ frequency

layers:

* 1. Lowest
  2. Highest
  3. Shortest
  4. Brightest