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Q No 1 #:

Ans:- Preprocessing :-

=> Preprocessing is designed to produce artifact - Free digital Images.

=> In this regard, preprocessing provides electronic calibration to reduce pixel- to-pixel, row- to- row, and column- to- column response differences.

=> The processes of pixel Interpolation, lag correction, and noise correction are automatically applied with most Systems.

Digital Image preprocessing:-

Problem	Solution
Defective pixel	Interpolate adjacent pixel
Image lag	Signals
Line noise	offset Correction
	Correct From dark reference Zone.

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=> offset Images and gain Images are automatic calibration Images designed to make the response of the Image receptor Uniform.

=> Gain Images are generated every few months, and offset Images are generated many times each day. These preprocessing calibration techniques are identified as flatfielding.

=> Averaging techniques also are used to reduce noise and Improve contrast.

=> Digital Image receptors and display devices have millions of pixels. Therefore, It is reasonable to expect Some Individual pixels to be defective and to respond differently or not at all. Such defects are corrected by

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=> Signal interpolation:-

The response of pixels surrounding the defective pixel is averaged. and that values is assigned to the defective pixel.

=> Each type of digital acceptor generates and electronic latent image that my be not be made visible completly what remains is image lag. The Solution is application of an offset. voltage before the next image is acquried.

= Some voltage variations may be seen along the buses that drive each pixel. This defect, called line noise, can cause linear artifacts to appear on the final image. The Solution is to apply a voltage correction from a row or a column of pixels in a dark. Uniradiated area of the image receptor.

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Post processing:-

=> Post processing is where digital Imaging Shines. In contrast to preprocessing. Which is largely automatic postprocessing requires Inter Intervention by the radiologic technologist and the radiologist.

=> postprocessing refers to anything that can be done to a digital radiograph Image after it is acquried by the Imaging System.

=> postprocessing of digital Image is performed to optimize the appearance of the Image for the purpose of better detecting pathology.

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=> Annotation is the process of adding text to an Image.
In addition to patient identifaccation annotation is often help ful in informing the clincain cohort anautomy and diagnosis.

=> By window and level adjusment, the radiogic technologist can make all 65,536 shades of gray visible. This amplifercation of Image. contrcyt may be that rost important feature of digital radio graphic Imaging.

= The larger matrix size digital display devices have better Spatial resoulution because they have smaller pixel. This allows among other propeties, Magnificcation of a an Image to tender the smallest detail.

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visible.

At times, multiple digital images must be flipped horizontally or verticulley. This process, called Image Flip.

However, Sometimes pathology can be made more visible with Image Inversion. which result in a black appearance of bone and white appearance Soft tissue.

> Subtraction of digital radiographic Images obtained months apart - temporal Subtraction - is used to amplify change in anatomy or disease.

⇒ Misregistration of a Subtraction Image occurs when the patient moves during Serial Image acquisition. This can be corrected by re-registering the image through a technique called pixel Shift.

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=> Greater use is being made of quantitative Imaging. that is, use of the numeric value of pixels to help in diagnosis. This requires identifying a region of interest (RoI) and computing the mean pixel value for that RoI. This is an area of digital Imaging that has been identified as quntitative radiology it is finding application in bone mineral assay; calcified lung nodule detection. and renal stone identification.

=> Edge enhancement is effective for fractures and small, high - contrast tissue.

=> Highlighting can be effective for fracture and identifying diffuse non-focal diseases, pan, scroll, and zoom allows for careful visualization

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of Precise regions of an Image.

(Q) No (2) 0°

Ans: Distinguish between the Spatial Resolution and Contrast Resolution.

Ans:

	Spatial Resolution	Contrast Resolution
=>	Spatial resolution is the ability to Image Small Structures that have high Subject Contrast Such as bone — Soft tissue Interface.	Contrast Resolution is a ability to distinguish Structure with Similar Subject contrast Such as liver - Spleen, fat - muscle.
=>	When all of the factors are Correct, Conventional radiography hey excellent Spatial Resolution.	Computed tomography and MRI have excellent Contrast Resolution. Convention radiology to poor.

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⇒ Resolution in. Space. is the ability of an imaging System to resolve and render on the image a small high-Scale Contrast Object.

⇒ Usually described as the size of the object that can be viewed.

⇒ In medical mededicene, it is described by the quantity "Spatial frequency"

Contrast resolution describes the property of distinguishing between Similar tissues, For example gray-white matter in the liver and the brain differentiating between the liver and Spleen.

plian film radiography tends to lack Contrast resolution (it has great Spatial resolution however).

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(Q) No (3)

Ans:- Chareterstic of digital imaging should result in lower patient does:-

=> There are Umber of factors assosted patient radiation does.

=> Digital radiographic technique especially Section of kvp and mAs can result to reduce patient radiation does.

=> When the mAs decreased the SNR also decreased with lowered patient does

=> The property of the distal image receptor called DQE can reduce patient radiation does due to ~~th~~ high receptorse to x-rays.

=> kvp is not assoeited with patient does but contrast Spotial resolution & proper focal Spot Size result in a ~~technique~~

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lowering patient does

=> Technique does Should replace does creep

=> Exposure Show not be repeated In digited radiography because of brightness or Contrast Concern.

=> DR System cannot Compensate for excessive noise caused by Quntum mottle.

=> over exposed Image do not have to be decepted and should not becomes a habit.

=> With digital radiography about 20- 50 % patient does (radiation) decrease.

Other Common- factors:

=> proper Collimation

=> Filtration

=> GRID

=> EXPOSURE TIME ASSURACY

- protetive Shilding

=> @ Focal Spot Size

@ .t.c.

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(Q) No (4) 80

Active Matrix Liquid crysted displays :.

Ans => The active matrix liquid crystal display is also know as a thin film toansfor display. The TFT is patterneed into the cadey layer. which has as toansistor located at each pixel intersection, requring loss current to Control the luminance of a pixel.

=> It is not limited to about 50 rows.

=> They are produceed in tube furnaces.

=> Fast response time.

=> Cood Image quality.

=> electric charged is Stored between defroshes.

=> Scanned one row at a time.

=> Switching element at each pixel. Individual pixels isolated from each other.

=> Each row line is activated Sequentially (Scanned one row at a time)

=> Used in Computer displays.

=> A Switching device and a Storage capacitor are Integrated at the each cross Point of the electrodes.

=> Each row line is activated Sequentially.

=> Used in computer displays.

=> A Switching device and a Storage capacitor are Integrated at the each cross Point of the electrodes.

Advantage:

=> Higher Size

=> Higher Contrast

=> Higher grey Scale

=> Higher resolution

=> Higher viewing angle

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Feyster respone Eliminctes
" ghosting"
Better Control of the Color.

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(2) No (5) (8)

Ans: PICTURE ARCHIVING AND COMMUNICATION SYSTEM (PACS):-

⇒ Radiology is adopting digital imaging very rapidly. Estimates of the present level of digitally acquried images range up to 40 %. These digital Image come From every area of medical Imaging Including nucdecs Medicine, diagnostic Ultrasonography radiography. Fluoroscopy, CT, and MRI.

⇒ A picture archiving and communication System. (PACS). When fully implemented, allows not only the acquisition but also the Interpretation and Storage of each medical Image in digital from without resorting to Film (hard copy) The projected efficiences of film and Cost are enormous.

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⇒ PACS Improves Image Interpretion, processing, viewing, Storage, and recall.

⇒ The four principal commponents of a PACS are the Image acquisition System, the display System, the network, and the Storage System.

⇒ In Some countries, national networks are used for medical data. All patients have a unique identifier, a number that is exclusively theirs for life.

⇒ Any hospital at any enter the unique identifier. a number that is exclusively ther for files.

⇒ In radiology in addition to Sectorial Workstations. the network may consist of views of device that allow Storage, retrieval, and viewing of images.

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PACS Work Station, a departmental mainframe and a hospital mainframe (Figure 18-1).

=> Each of these device is called a Client of the network.

=> At any time, Such Image can be transfered to other client

=> Within or outside the hospital Intead of running Films Up to Surgery for viewing on a Viewbox. one Simply transferts the Image electronicalley to the PACS Work Station In Surgery.

=> Time is essentail when one is considering Image manipulation. therefore, fast Computer and network with broad bandwidth are requried for this task.

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(Q) No (6):

Ans: Three types of digital radio graphic imaging artifact:

Types :

(1) processing

(2) EXPOSURE

(3) HANDLING AND STORAGE

(1) processsing:

=> Hyperretention

=> pi-lines

=> Guide Shoe Mark

=> Static

=> Enterance Roller Mark

=> CRinkle Mark

=> Finger Marks.

=> EMULISON Pick-OFF

=> WATER STAIN

(2) EXPOSURE :

=> MOTION

=> IMPROPER POSITIONING

=> POOR FILM SCREEN CONTACT

=> DOUBLE EXPOSURE.

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⇒ FOREIGN OBJECTS

⇒ BACK- SCATTER

⇒ CASSETE UPSID- DOWN

⇒ BROKEN CASSETE

⇒ IMPROPER USE OF GRID

(3) HANDLING:-

⇒ LIGHT FOG

⇒ RADIATION FOG

⇒ STATIC

⇒ SCRATCHES

⇒ HYPERTENTION

An this three Factor aviod to themgo

=> The person who is holding the patient must always wears a protective aporn and, in possible. protective gloves

⇒ Use gonadal shields on all people of childbearing age when such use will not interfese with the examination.

⇒ Always wear protective apparenl when not behind a protective barrier.

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(Q) No (7):

Ans: **Data Compression:**

Data Compression takes advantage of redundancy of data. as occurs with exposure to the raw x-ray beam when all values are the same. Such Compression techniques are described as lossless or lossy.

	Lossless Compression	lossy Compression
=>	An Image file that is compressed in a lossless mode is one that can be reconstructed to be exactly the same as the original image lossless Compression reduce the data ~~to~~	which can provide compression factors of up to 100:1 or greater, can be used on image in which exact measurement or fine detail is not required.

File to 10% (10:1) to 50% (2:1) of the original File.

= However, this is not Satisfactory For large image Files because transmission time and data manipulation time can still be unacceptable.

=> lossless Compression up to 3:1 generally is considered acceptable and help ful in digital radiography Image Management.

such as video recording that are to be replayed on a standard domestic television.

lossy compression is that which is something greater than an order of magnitude Compression less than 10:1 Such a level of compression Support teleradiology but not computer-aided detection ((AD) or image arachiving. CAD Systems require Uncompressed (Which actually represent a lack of date. lossy comp is not acceptable For this reason.

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Q No (8)

Ans: The difference between For-processing Image and For-presentation Image:

=> Pt is For-processing mean In relation to Sorp Software artifect.

=> These image for are manipulated into for presentation Image that Cenn then be Used by the rad for Qc.

=> For presentation mean In relation to Software artifact. These Images are Used For Qc by the rad teach and are Interpreted by the radiologist.

=> For processing Image. Sets. As Such, these images are ready for manipulated into For presentation image that the radiologic technologist Can Use For Qc and For Interpretation the radiologist.

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Digital radiographic images are obtained as raw data set.

⇒ Before an Image is prepared. For processing Serval manipulations of the out put of an Image receptor may be necessary to correct for potential artifact. Such artifact can occar because of dead pixels or dead rows or columns of pixels.

⇒ A single pixel or a Single row or column normally will not interfere with diagnosis. However, many of these defects must be corrected. Correction algorithms Specific to each type of digital Image receptor use.

⇒ A Note the White Shapes on the left side, which resulted when the computed radiography (CR) Imaging plate

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Come apart, B This is the CR plate, which show Cornner damage and peeling (Courtesy Barbara Smith Pruner, Portland Community College.)

Interpolation techniques to assign digital values to each dead pixel, row, or column.

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(Q) No (9)

Ans. Digital radiographic Image Artifacts:

⇒ The artifacts can arise from the technologist's errors in patient positioning x-ray beam collimation, and histogram selection.

⇒ Backscatter radiation also can be troublesome because of the sensitivity of the digital radiographic image receptor.

⇒ If a lot of scattering material is present behind the image receptor. backscatter radiation can cause an phantom image. If this type of artifact is discovered. the back side of the image receptor should be shielded to reduce back-scatter x-ray.

Ans: (Q.6)

⇒ Artifact is defined as any opacity on the radiograph which does not correspond to an actual anatomic Structure.

⇒ Any misinterpretation of an actual anatomic Structure.

⇒ Anything decreasing radiographic quality.

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Colimation and partitions:

=> If the x ray exposure field is not properly colimated, sized and possitioned, exposure field recognition errors may occure.

=> The result is very dark or very light or very noisy images

=> Automatic radiation field recognition is essential for artifact - free images.

=> Colimation of the projected area-x.ray beam is important for patient radiation does reduction and for improved image contrast in Screen - Film radio graphy.

=> In DR, proper collimation has the added value of defining the Image histogram. If improperly collimated, the histogram can be improperly quantized, resulting in a artifact.

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→ proper Colimation and Centering prevent histogram errors that can lead to artifacts.

Alignment:

⇒ Alignment of the exposure field on the IP is important in the same way and for the same reason as Colimation.

⇒ When an Image field such as that shown in Figure 21-20, is not oriented with the size and dimensions of the IP, image artifacts can appears

End