



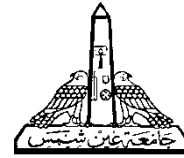
1. A common measure of transmission for digital data is the baud rate, defined as the number of bits transmitted per second. Generally, transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information, and a stop bit. Using these facts, answer the following:
  - (a) How many minutes would it take to transmit a 1024X1024 image with 256 gray levels using a 56K baud modem?
  - (b) What would the time be at 750K baud, a representative speed of a phone DSL (Digital Subscriber Line) connection?
2. High-definition television (HDTV) generates images with a resolution of 1125 horizontal TV lines interlaced (where every other line is painted on the tube face in each of two fields, each field being 1/60th of a second in duration). The width-to-height aspect ratio of the images is 16:9. The fact that the horizontal lines are distinct fixes the vertical resolution of the images. A company has designed an image capture system that generates digital images from HDTV images. The resolution of each TV (horizontal) line in their system is in proportion to vertical resolution, with the proportion being the width-to-height ratio of the images. Each pixel in the color image has 24 bits of intensity resolution, 8 pixels each for a red, a green, and a blue image. These three “primary” images form a color image. How many bits would it take to store a 2-hour HDTV program?
3. Show that in a properly focused imaging system the distance from the lens to the image plane is equal to  $3f$ , when  $f$  is the focal length and the magnification is  $2$ . This distance is called the effective focal length. Show that the distance between the image plane and an object must be  $4f$  if the magnification is *unity*.
4. Manually, decompose the following image into 2, 4, 8, and 16 intensity levels respectively:-

**Fourth Year Mechatronics Department**

CSE496: Digital Image Processing

Sheet #01: Digital Image Fundamentals

Spring 2015



**Ain Shams University**  
**Faculty of Engineering**

111	94	93	89	105	102	110	107
103	92	102	75	100	91	111	102
77	111	103	119	108	102	107	116
106	92	92	93	120	85	101	102
80	94	86	98	85	98	107	101
117	94	118	114	100	102	117	92
93	107	111	133	103	113	97	102
92	80	105	102	89	111	92	86

- Convert the resolution of the above image into: (a) 2X2 and (b) 4X4. What will be the resulting image in each case?
- Show how to modify the resolution of a 2X2 image to become 4X4. Give an example by numbers.
- Show manually how to rotate a 5X5 image by an angle of 45° clockwise. Give an example by numbers.

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