Digital technology review questions

Analogue and digital signals

1) (a) Convert the binary number 10111 into decimal (b) Write 200 as a binary number

2) Compare one digital and one analogue storage method for video in terms of:

(a) The medium and method used to store the data

(b) The method of data retrieval

(c) The accuracy of the data storage and retrieval.

3) A standard CD can store 700 MB (700×2^{20} bytes) of data [http://en.wikipedia.org/wiki/Compact_Disc]. The distance between the tracks, the pitch, is 1.6 µm. The storage area occupies a radius from 25 to 58 mm. Scanning velocity is approximately 1.3 ms^{-1}. Approximate:

(a) The number of tracks that would fit into the storage area of the disc?

(b) The average circumference of a track?

(c) The total track distance and the distance along the track that one bit of data occupies

(d) The time taken to play a full CD and the bit rate of data retrieval.

4) Outline the advantages of storing data in a digital format compared to an analogue format

5) "The global information and communications technology (ICT) industry generates as much CO_2 as aviation" [http://www.pcpro.co.uk/news/111643/computing-rivals-aviation-for-co2-emissions-gartner]

(a) "Computers use electricity not fuel". Explain what is meant by this statement.

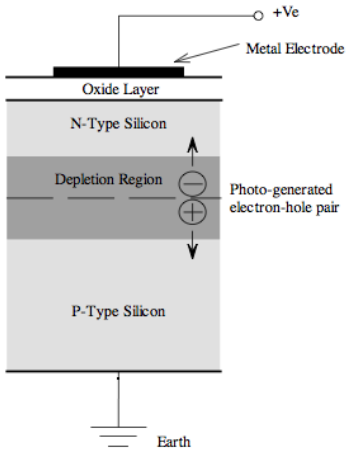
(b) What else, apart from running computers cause the ICT industry to generate CO_2?

(c) Discuss one ethical consideration of storing vast amounts of data digitally.

CCD's [http://www.vikdhillon.staff.shef.ac.uk/teaching/phy217/detectors/phy217_det_structure.html]

6) Define capacitance.

7) By referring to the diagram on the right explain how a CCD device is similar to an array of capacitors that are charged up by light.



8) What is measured and converted to a light level for each pixel?

(a) Current (b) Potential Difference (c) Charge (d) Capacitance

9) Use the formula Q = VC to explain how the number of photons effects the measurement made from each pixel.

10) Define quantum efficiency of a pixel

11) Define magnification and explain why a magnification of 1/10 results in an image being 1/100 the size of the object.

12) How much gap must there be (in pixels) between two parts of an image for the two parts to be resolved on an image?

13) The Hubble Space telescope has a CCD array that is sensitive to radiation from ultraviolet to near infra-red. What range of wavelengths is this:

(a) 20- 1000 fm (b) 20 – 1000pm (c) 20- 1000 nm (d) 20- 1000 µm

14) Outline some uses of CCD devices in systems that detect parts of the electro-magnetic spectrum not visible to the eye.