

CSCI 120 Introduction to Computation

Homework 6

Solution

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PART 1: I/O ports

(a) Describe the difference between a serial port and a parallel port and list an example of each.

ANSWER: With a serial port, information is communicated one bit at a time. With a parallel port, information is communicated by multiple bits in parallel. An example of a serial port is USB. An example of a parallel port is PATA.

(b) Which of the following interfaces is recommended for hard drives in today's PCs: Skuzzy, IDE, PATA, SATA? Give at least two reasons for such preference.

ANSWER: SATA is now recommended, for the following reasons:

- SATA is serial (less wires)
- affordable
- SATA has a high bit rate (fast)
- SATA has high addressing capacity (larger drives)

(c) Explain the term “twisted pair wire” and elaborate on why they are preferred over regular wires.

ANSWER: A twisted-pair wire consists of two wires twisted together. One wire carries the opposite signal of the other. This eliminates interference with other wires. If another wire is affected, it is affected by both wires of the twisted pair. Since they carry opposite signals, the effect is cancelled. Moreover, even in the presence of such effect, by only taking the difference of the two signals at the receiving end, any effect will also be cancelled.

(d) Explain the difference in how a mouse, a printer, and a video camera communicate over a USB port.

ANSWER: see notes on interrupt, bulk, and isochronous modes.

PART 2: I/O devices

(a) A 3.1 megapixel digital camera takes pictures with a 3:2 ratio. What should be the largest print size to maintain good quality?

ANSWER: Good quality can be achieved with 300 ppi. Therefore, each square inch must have 90000 pixels. Since we have 3.1 megapixels, the number of square inches we can have is at most $3100000/90000=34.44$. With a 3:2 ratio, this must be equal to $1.5h^2$, where h is the height of the pictures. Therefore, $h = 4.79$ inches. The width will be 1.5 times that which is 7.18 inches.

(b) Explain how an LCD works and list at least two advantages over CRTs?

ANSWER: see note 11

(c) List few image formats and provide a comparison between them in terms of quality, size, and portability.

ANSWER:

BMP: very good quality, but large file size

JPG: not so good quality, small file size, portable

GIF: good quality with few colors, small file size, portable

(d) Explain the following terms: resolution, dot pitch, PPI, DPI, and NIT.

ANSWER:

- PPI : pixel per inch, number of pixels per inch, relevant when viewing pictures
- DPI: dot per inch, number of dots per inch, relevant for printers when performing dithering, see note 11 page 4.
- dot pitch: distance between two pixels in millimeters on CRT monitors
- NIT: unit of illumination, measures brightness of LCD

PART 3: Coloring

(a) Do some Internet research on the 4 coloring theorem and write a paragraph or two on what you find interesting regarding the topic.

ANSWER: check <http://www.math.gatech.edu/~thomas/FC/fourcolor.html>

parts (b), (c), and (d) not to be handed in, just for fun.

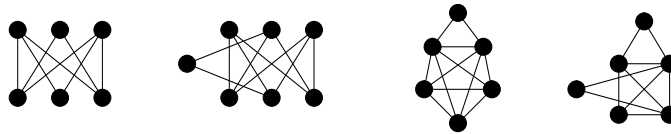
(b) Download the file map.bmp from the course web site and color all the states in the map using only 4 colors such that every two neighboring states will have different color.

(c) Save your colored map as BMP, GIF, and JPG. Observe the quality of the images and the size in KB of the corresponding files.

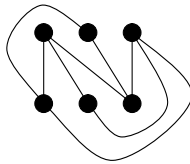
(d) Download fb.exe from the course web site. Using fb -b followed by the file name, read the binary files for each of the formats you produced in (c) and observe why the BMP format is called a bitmap.

PART 4: Planar graphs

For each of the following graphs, determine which is planar and which is not. If planar, redraw the graph to show that property, if not, say why (usually the way you show that a graph is not planar is by showing that if it is planar it would imply that $K_{3,3}$ or K_5 is planar).



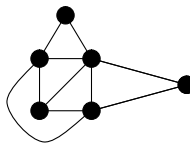
The first one is planar because it does not contain any of the two shapes K_5 or $K_{3,3}$. It can be redrawn as follows:



The second one is non-planar because it contains $K_{3,3}$ (with one node inserted in the middle edge).

The third one is non-planar because it contains K_5 .

The fourth one is planar because it does not contain any of the two shapes K_5 or $K_{3,3}$. It can be redrawn as follows:



PART 5: Binary search trees

For the set of numbers $\{1, 4, 5, 10, 16, 17, 21\}$, draw binary search trees of height 2, 3, 4, 5, and 6.

ANSWER: In a binary search tree, every node must satisfy the property that everything to its left is smaller, and everything to its right is larger. There are many possible trees for a given set of numbers. The smaller the height of the tree, the faster the search. The following shows example trees of heights 2, 3, 4, 5, and 6.

