Space Hardware Experiment Design

ASEN4519 / 5519

Homework #4

Name: _____ *Date:* _____

Social Security Number _____ _____

Note: You may have to make assumptions (and properly state those) to solve the problems (that's life). Not all required information may be given. If in doubt, simplify with real life assumptions. This test is meant to be easy. Don't hesitate to ask questions (303) 492-5875 or email (hoehn@spot.colorado.edu) if you get stuck.

Question 2 - Control Computer:

You want to control the temperature in your experiment. What generic (black box) components do you need to:

- control the temperature to 37°C in an ambient environment of 25°C, while:
- recording the actual temperature in a data file for later analysis

You do not have to display or adjust the temperature, just control and record. Cost and complexity are not the issue.

You can pick from the following components (more listed than you need !!)

◊ CPU with program memory (RAM), serial, parallel, keyboard, screen, IDE disk controller, running at 5 VDC, bus connections for add-on card such as A/D, DIO, frame grabber, network cards, …..

◊ 12 bit A/D converter, 16 channels single ended, +5V, ±5V, +10V and ±10VDC range, powered through the computer bus, data transfer through the computer bus

◊ 32 channel DIO (digital input and output card), TTL compatible, maximum output current per channel is 5 mA. Powered through the computer bus, data transfer through the computer bus

◊ Ethernet network card, powered through the computer bus, data transfer through the computer bus

◊ Video frame grabber, color. Powered through the computer bus, data transfer through the computer bus

◊ 200 MB harddisk, , powered through the computer, data transfer through the IDE controller on the CPU.

◊ solid state relay, TTL compatible, can be switched with 2 mA current, can switch 3 Amp DC loads.

◊ heater strip, running at 12 VDC, 1 Amp.

◊ power supply, providing 5 VDC

◊ power supply providing 12 VDC

◊ power supply providing 28 VDC.

1. Check those components you need !

2. Draw simple block diagrams (each picked component = 1 box) and connect the different components with each other (draw lines) as needed and indicate next to the lines what kind of connections are needed between those components (power, data, signal).

Question 4 - Video:

You want to digitize video on your computer as well as download video images using the Orbiter data transfer system.

a) How many gray scales can you display at 16 bit black and white and how many colors at 16 bit color resolution ?
b) your video camera has a CCD with 640x480 pixel. What is the approximate file size for the image file if you use 16 bit black and white, what if you use 16 bit color ?
c) How long to download the file using a typical Orbiter data transfer rate of 500 bits per second. How much from your home if you use your 33 kbits/second modem.
d) How many images can you save on a 80 Mbyte (1 byte = 8 bits) disk for either the black and white or the color image ?
e) If you have a CCD camera with 640x480 pixels TOTAL, and you can choose between a color or black and white camera, which one has the better resolution ?

CCD size	16 bit black and white	16 bit color
# of colors / gray scales		t =
file size at 640x480 pix.		t =
Time to download at 500 bits per second		
Time to download at 33 kbits/second		
Images per 80 Mbyte disk		
Better resolution ? B/W vs. Color, which and why ?		

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