Question: How many different colors can be displayed with this VGA controller?

* 256

Question: What values on the RED0, RED1, RED2, GRN0, GRN1, GRN2, BLUE0, and BLUE1 signals are needed to generate the “full intensity” red color (i.e., provide the maximum analog voltage on the RED signal and the minimum analog voltage on the GREEN and BLUE signals)?

* RED0, RED1, RED2 = 1, GRN0, GRN1, GRN2 = 0, BLUE0, BLUE1 = 0

Question: What is the voltage on the Green analog signal if the values of Green are: GRN0=1, GRN1=1, and GRN2=0?

* 510 \* 3.3 / (510 + (2k||1K)) = 1.43V

Question: What is the frequency of the pixel clock for the 640x480 VGA resolution?

* 800 / 32us = 25MHz

Question: What is the frequency of the horizontal sync signal (HS) for the 640x480 resolution?

* 1 / 32us = 31.25kHz

Question: During the scan of one horizontal row, 640 pixels are displayed. However, additional time is needed during the horizontal scan for retracing. How many pixel clocks are needed during each horizontal sync for this retracing (i.e. how many pixel clocks are used when no pixel is displayed in a horizontal scan)?

* 160 clock cycle

Question: How many frames per second are generated with this timing?

* 1/(521\*800\*40\*10^-9) = 59.98 frames

Question: How many lines are NOT displayed during a full frame (i.e. lines that are blanked during a vertical retrace)?

* 41 lines

Question: What is the minimum clock period of your circuit (review the “Post-PAR Static Timing Report” and search for “Minimum period”)?

* 3.192ns

Question: Review the “Map Report” and determine the number of “slices used by your design.

* 51 slices

Personal Exploration

* It was cool to learn how VGA monitor works. Once I created timing controller and top-level design, changing colors displayed on the monitor was not difficult at all. Counters were definitely very important for digital circuit design and had to be understood firmly.