1. (5 points) The diagram to the right shows a 7-segment LED display. Using such a device, you can display the decimal digits from 0 to 9 by specifying which segments to light. Digits look like this:

![7-segment LED diagram]

Suppose $R(d)$ is the bit string representing digit $d$, with respect to reference list ABCDEFG. For example, $R(2) = 1101101$ because to display a 2, we light segments $\{A, B, D, E, G\}$.

Answer the following questions with 7-bit strings, except (a) which requires a number.

(a) __________________ How many different bit patterns are possible (some may not represent digits)?

(b) __________________ What is $R(3)$?

(c) __________________ Suppose the digit 7 is displayed. What bit string would you XOR with the display to turn it into a 2?

(d) __________________ What is $R(4) \lor R(5)$?

(e) __________________ What is $R(6) \land R(5)$?

2. (2 points) By default in x86-64, the stack:

(a) is located in the heap
(b) is located at the “bottom” of memory
(c) grows up toward larger addresses
(d) grows down toward smaller addresses

Page total: ____/7
3. (5 points) Suppose you have a 5-bit two’s complement number system. For each of the following, show the 5-bit binary representation you’d get if you entered the number into this system. *All have 5-bit answers.*

(a) $-2$  
(b) $7$  
(c) $-17$  
(d) $T_{\text{Max}}$  
(e) $T_{\text{Min}}$

4. (6 points) For each of the following, round the indicated value to the fourths position (leaving 2 bits after the binary point) using the indicated rounding mode.

(a) $11.1111$  (round down)
(b) $11.1111$  (round to even)
(c) $11.1111$  (round up)
(d) $11.1110$  (round to even)
(e) $-11.1110$  (round toward zero)
(f) $-11.1110$  (round to even)

Page total: _____/11