HW4 Answer Keys/Tips

Q1

One logic expression has two product terms and others have three product terms.

Here is the output of the program on another string. Test your program with more random bit strings and decide yourself if the state machine works correctly.

```
python q1.py 110101
state b | ns z v
  0   1 | 1  0 1
  1   1 | 0  1 3
  0   0 | 0  1 6
  0   1 | 1  0 13
  1   0 | 2  0 26
  2   1 | 2  0 53
  2   1 | 2  0 107
```

Note that we first write logical expressions from the truth table. They are in the sum of products form. MyHDL code just implements the logical expressions.

Although it is not required, you can generate the trace file (a VCD file) with `--trace` option on the command line and observe the waveforms of signals.

Q2

The figure in 2.a should be helpful to find the answers to other questions.

The answer to 2.c is about 83 MHz.

The answer to 2.d is 500 MHz. Study the figure in 2.a and think about how you can reduce the cycle time/increase the clock rate.

Q3

The product is 0b0111001011.

For two's complement numbers, find the product in decimal, convert it to a 2's complement number (i.e., find its representation in 2's complement number), and compare the lower halves.

Q4

Check a) the code can print correct strings, and b) registers are saved/restored properly in the function.

Compare the algorithm we (humans) convert a decimal number to a binary number.