Introduction to Digital Design with Verilog HDL

Exercise 1: What changes would result in a 3-input OR gate?

Exercise 2: What schematic would you expect if the statement was `assign y = ( a ^ b ) | c ;?`

Exercise 3: What are the lengths and values, in decimal, of the following: `4'b1001`, `5'd3`, `6'h0_a`, 3?

Exercise 4: If the signal `i` is declared as `logic [2:0] i;`, what is the 'width' of `i`? If `i` has the value 6 (decimal), what is the value of `i[2]`? Of `i[0]`?

Exercise 5: An array declared as `logic [15:0] n;` and has the value `16'h1234`.

What are the values and lengths of the following expressions?

```
n[15:13]
!n
~n[3:0]
n>>4
n + 1'b1
n[7:0] - n[3:0]
n >= 16'h1234
n ^ ~n
n && !n
 n * ( !n + 1'b1 )
```

Exercise 6: What is the value of the expression `3 ? 10 : 20`? Of the expression `x ? 1 : 0` if `x` has the value 0? If `x` has the value -1?

Exercise 7: Draw the schematics corresponding to:

```
y = a ? s1 : b ? s2 : c ? s3 : s4;
y = a ? ( b ? s1 : s2 ) : ( c ? s3 : s4 );
```

Exercise 8: Use slicing and concatenation to compute the byte-swapped value of an array `n` declared as `logic [15:0] n`.

Exercise 9: If `n` has the value `16'h1234`, what is the value and length of `{n[7:0],n[15:8],4'b1111}`?

Exercise 10: Use concatenation to shift `n` left by two bits.

Exercise 11: Use concatenation to assign the high-order byte of `n` to `a` and the low-order byte to `b`.

Exercise 12: How would you specify the bit marked A in the diagram above? The bits marked B? The least-significant byte?

Exercise 13: Define a Verilog lookup table named `isprime` that can be used to determine if a value between 0 and 7 is a prime number or not. The result should be 1 if the value is a prime or else 0. *Hint: The primes are 2, 3, 5 and 7.*

Exercise 14: Write an `always_ff` statement that toggles (inverts) its output on each rising edge of the clock.

Exercise 15: Label the signal `t` in the schematic.

Exercise 16: Rewrite the `ex60` module using operators. Which version – “structural” or “behavioural” – is easier to understand?