Homework 4

In your own words (five-point penalty, per problem/question, for duplicating the textbook answer)

1. Under what conditions is overflow possible? Why?

*Overflow can occur when the leftmost retained bit of the pattern is not the same as the infinite number of digits to the left. Overflow can occur when the result from an operation cannot be represented with the available hardware. This is when there are not enough bits to store the answer from an operation.*

1. Under what conditions is underflow possible? Why?

*When negative exponent is too large to fit in the exponent field. It can also occur if both operands are small (if both have a really large negative exponents)*

*One way to reduce the chances of overflow and underflow is to offer another format with larger exponent.*

1. Under what conditions do floating point numbers represent something other than a number and what do they then represent?

*When a number is bigger than what it can be stored in a 32-bit signed integer, then the alternative to that is representing it as a scientific notation.*

1. What operations might be performed on the PC (Program Counter)?

*The program counter contains the address of the instruction in the program that is being executed. It supplies the instruction address to the memory. Program Counters can be incremented so that it will point to the next instruction, 4 bytes later.*

1. What are control signals and where are they produced?

*Control signals are used for multiplexor selection or for directing the operation of a functional unit. Control signals are a component of the CPU that directs the operation of the processor.*

1. What is the datapath? How does it differ from the control path?

*Data Path is the flow of instruction being executed, while the control path is more about control in hardware that tells the datapath what to do, in terms of switching, operation selection, data movement between ALU components.*

1. Why have single-cycle implementations become obsolete?

*It is not used in modern design because it is inefficient. This is because the clock cycle has to have the same length for every instruction in the single-cycle design. Since it uses to many functional units the overall performance of a single-cycle implementation is poor since the clock cycle is too long.*

1. Describe the two basic forms of logic.

*Combinational and Sequential logic. In a combinational logic, the inputs come from a set of state elements and the outputs are written into a set of state elements which operates in a single clock cycle. When given the inputs the current state, it can determine the next state of a finite-state machine. While, sequential logic elements are updated only at a clock edge, which is a better transition from low to high (vice-verse). Sequential logic consists of a set of input and output, a next-state function that maps the current state and the input is sent to the new state. The output maps the current state.*

1. What are hardware description languages (HDLs)? What are the two most common HDLs?

*HDL is a programming language used to descrive the behavior and structure of a digital circuit and check its responses. Verilog and VHDL are the two primary hardware description languages.*

1. Describe the elements of a finite state machine (FSM) diagram.

*FSM are typically implemented using a block of combinational logic and a register to hold the current state. The first element is the set of states, then a set of transitions between states, and a set of actions associated with each transition. FSM are usually associate with entering, exiting, or remaining in a certain state of action. The Finite State Machine consists of a set of potential input events then the set of probable output events that corresponds with it. FSM diagram typically describes the state-dependent behavior for an object. The initial state is known as pseudo-state and can be observed as a solid filled circle. Transition from this state will show the real first state. Lastly, the final state shows us the termination.*