Flip-Flop Logic Problems

Develop solutions to two of the following problems using sequential logic (flip-flops).

1. The security company responsible for security at the Sky Dome has decided to give extra scrutiny to every 7th person to come through each turnstile. They have commissioned you to design a circuit which will turn on an indicator light when a switch on the turnstile is activated seven times, and then reset to 0. (Use only Flip-flop circuits, not counters). How would you modify your circuit if the company wished to identify every 5th visitor.

2. In a computer system, the system clock has a frequency of 66.6 MHz. The PCI bus operates at 33.3 MHz and the ISA bus operates at 8.33 MHz. Design a circuit which will have the 66.6 MHz signal as the input and outputs of 33.3 MHz and 8.33 MHz.

This is a square wave signal generator as ;modeled in Crocodile Physics.

3. Competitors in a race must carry a small electronic device which has four key switches. A judge at each checkpoint will insert a key in a different switch and then remove it. Create a circuit which will turn on a light when all four keys have been inserted.

4. A security system has four input buttons - A,B,C,D – and a reset button. Design a circuit which will turn on an output to unlock the door only if the buttons are pressed in the sequence CBDA. Bonus marks: disable the circuit after three incorrect tries.

You may test your circuit using Crocodile Clips, but your solutions are to be presented as logic drawings on paper. All components, inputs and outputs on the drawing should be labeled, and an explanation of how the circuit works should accompany each circuit. Marks will be awarded for originality and circuit enhancements, so be careful what you share with your classmates.

Evaluation Rubric

	Level 1 (50-59%)	Level 2 (60-69%)	Level 3 (70-79%)	Level 4 (80-100%)	Value
Problem Solving (Thinking & Inquiry)	Attempted solutions to two problems with limited success.	Workable solutions, but partial or needlessly complex.	Correct, workable, simple solutions to two problems.	Correct, original, elegant solutions with extra features.	10
Circuit Design (Application)	Circuits incorrect or impossible to understand.	Circuits correct but too complex or hard to follow.	Economical, simple, understandable circuit layout.	Exceptionally well-laid out circuits.	5
Explanation (Knowledge)	Incomplete and inaccurate explanations.	Incomplete or inaccurate explanations.	Accurate, complete explanation of circuit operation.	Explanation shows insight and analytic skills.	5
Drawings (Communication)	Drawings are sloppy and unlabelled.	Drawings are sloppy or unlabelled.	Neat, clean drawings with all parts labeled.	Exceptionally well-organized and labeled drawings	5
Total					25