This is a general outline of what Mr. Galipeau expects to see in your video lab report. You must evenly split this 50/50 between you and your lab partner. I am leaving the specifics up to you, but recall how it works for your lab reports.

Introduction (1 minute; 5 points)

At a high-level, describe the description of the device you are going to be building (10-bit computer processor). What is a real-world application of your work? Briefly describe the implementation on a DE10-Lite board with FPGA. This should be general ie the seven segment displays were used to show x; **don't** include specific pin outs. One sentence takeaway on the outcomes of your project/design – what was accomplished and why is it important?

Video: this should be of you and your lab partner talking without slides. If using a script, it should not appear as if you are reading directly off of it (eyes on camera).

Theory (4 minutes; 12 points)

Fully describe the operation of the 10-bit processor. How will it work, and how will it be implemented? Each bullet point should be a single slide.

1. Start with the top-level diagram of your machine (**do not use mine, make your own or edit the one I provided you; do not use the RTL view**). Explain what the inputs and outputs to the machine are, and briefly discuss the need for each of your modules.
2. Show the instruction set and describe them (you do not need to go over each instruction, but in general you should discuss memory movement, ALU operations, and immediate instructions). If needed, you can go back to the top-level to describe the operation.
3. Show one example of a mnemonic and how you encode it as a 10-bit instruction.

Video: talk over the three PowerPoint slides

Theory of each module

Go through and describe the theoretical operation of each module, including inputs, outputs, and purpose within your machine. Each of these correlates to a slide and should explicitly mention in each module what are the controllable inputs (from your controller).

1. Instruction register
2. Counter
3. Register file: discuss the 4x10-bit registers, one write port, and two read ports
4. Multi-stage ALU (you should show each of the component pieces: A, ALU, G)
5. Controller (do not go over the design yet, just that the instruction and time will coordinate the many control outputs)
6. Output logic (including the peak)

Video: showcase each module slide from your PowerPoint. You should have pictorial representations of each module. Do not just copy and paste from your top-level.

Extra Credit

If you completed the extra credit, you will also need to discuss how you added each component to the top-level design of the machine (RAM for load/store, ROM for program memory). This should follow your discussion of the base project.

Procedure, Results and Analysis (6 minutes; 18 points)

Procedure

The procedure should focus on the design of the controller. Start with the table design (time count and instruction versus control outputs). It may make sense to break into five slides (up to you how you show this information): T0 (instruction load), memory movement, single operand ALU instructions, two operand ALU instructions, and immediate instructions.

Extra Credit

If you completed the extra credit, add two slides discussing the additional instructions, and the changes required to load memory from ROM on T0 instead of external data.

Results

Each of these should be a separate slide:

1. Discuss how you implemented the controller using SystemVerilog.
2. **Discuss how you mapped all of your inputs and outputs to the DE10-Lite board.** Put a table with inputs, and a table with outputs. **Do not screencap Mr. Galipeau's table.** This table should not be of the PINs of the DE10 board, rather the human understandable names (e.g., switch 1 or SW1).
3. Create a 5 instruction program table (mnemonic, 10-bit instruction) that you will go over in your analysis. You need at least one instruction showcasing each of memory movement, ALU operation, and immediate.
    a. **Extra Credit:** you also need to showcase your program using the ROM file, and add a RAM load/store instruction.

Video: this discussion should be over the PowerPoint slides

Analysis

Show the working operation of the 10-bit processor on your DE-10 Lite board that implements the program from the results section. Before starting, point out the inputs and outputs of your machine. You need to be sure to "peek" into the result after each instruction.

Video: this should be a voice-over recording of you demonstrating the operation on the DE-10 Lite board.

Comparison

Create one slide that compares the size (# of logic elements) and speed (Fmax) of your processor versus two other groups. Please share this info concerning your project with other teams that ask. If you did the extra credit, you should use the size and speed of your original project.

Video: this discussion should be over the PowerPoint slides

Conclusions (1 minute; 5 points)

Go over general concluding remarks talking about what you did and what the audience should have learned [main takeaways] from your video. Discuss what **you learned, mistakes you made, and improvements you would make next time.**

Video: this should be of you and your lab partner talking.

Overall video, image, equation, etc. quality (10 points)

Cite any material that you did not create yourself (on the slide reference/link will suffice). Hand drawn figures and tables will result in points deductions. Be sure to discuss the hardware implementation, not just the “code” that is SystemVerilog.