

## Lab1

EECS4312:  
Software  
Engineering  
Requirements

Preparation from  
Last week

To Do

Predicate Logic  
Majority Vote

To Submit

# Lab1

## EECS4312: Software Engineering Requirements

JSO, EECS, Lassonde

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- Predicate Logic
- Majority Vote

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# Preparation From Last week

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The site <http://seldoc.eecs.yorku.ca/> has PVS help (e.g. see *Getting started with PVS*).

From Last week (logon with EECS account):

- Logic and Set Theory <http://bit.ly/2cnawwN>
- Do the PVS WIFT tutorial, especially the telephone book example. <http://bit.ly/2cnfSIg>.

Quiz2:

Quiz2 will be based on Lab1, work done in class and readings.

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# Preparation before this Lab

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- Read the notes in `04-Predicate-Logic.pdf` (in the Lab1 directory) for how to prove predicate logic in PVS.
- Ensure that you know the proof rules for quantifier introduction and elimination.
- Study `05-Digital-Circuits` for how to specify and validate a majority voting circuit.

# Predicate Logic in PVS

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- Open the file `pred.basic.pvs` (in Lab1) with PVS and prove all the lemmas.
- Use `split`, `flatten`, `inst`, and `skolem` (or `skeep`), and their variants, as appropriate. Do not use the *grind* proof rule.
- Note that most of the lemmas can be discharged automatically with *grind*. However, doing *grind* will defeat the purpose

# Specify a Majority Vote Circuit

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- Start a new file in PVS called `majority_vote.pvs`, and enter the relevant specifications.
- Use `split`, `flatten`, `inst`, and `skolem` (or `skeep`), and their variants, as appropriate to prove the conjectures.
- You must prove the conjectures `implementation_correctness` and `implementable`. Do not use the *grind* proof rule, but you may use any other proof rules.

# Submit your work 1

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### ■ Create a PVS file `top.pvs`

```
% Exercises for Lab1
% proveit --importchain --clean top.pvs
top : THEORY
BEGIN
  IMPORTING pred_basic
  IMPORTING majority_vote
END top
```



# Submit your work 2

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- Create a directory 4312-lab1
- In the directory 4312-lab1 you should see:

```
majority_vote.prf  
majority_vote.pvs  
pred_basic.prf  
pred_basic.pvs  
top.pvs  
top.summary
```

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- In directory 4312-lab1 run the following command:
- `proveit --importchain --clean top.pvs`
- You should now see in `top.summary`:

```
Proof summary for theory top
  Theory totals: 0 formulas, 0 attempted, 0 succeeded (0.00 s)

Proof summary for theory pred_basic
  quant_0.....proved - complete [shostak](0.02 s)
  quant_1.....proved - complete [shostak](0.00 s)
  quant_2.....proved - complete [shostak](0.01 s)
  quant_3.....proved - complete [shostak](0.01 s)
  quant_4.....proved - complete [shostak](0.01 s)
  quant_5.....proved - complete [shostak](0.02 s)
  quant_6.....proved - complete [shostak](0.03 s)
  quant_7.....proved - complete [shostak](0.03 s)
  distrib.....proved - complete [shostak](0.02 s)
  Theory totals: 9 formulas, 9 attempted, 9 succeeded (0.15 s)

Proof summary for theory majority_vote
  implementation_correctness.....proved - complete [shostak](0.23 s)
  implementable.....proved - complete [shostak](0.02 s)
  Theory totals: 2 formulas, 2 attempted, 2 succeeded (0.24 s)

Grand Totals: 11 proofs, 11 attempted, 11 succeeded (0.40 s)
```

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- Now submit your 4312-lab1 directory:
- `submit 4312 lab1 4312-lab1`
- You will get confirmation of your submission.
- To obtain a grade for your quiz, all the proofs must be discharged as shown on the previous slid.