# CSE 4/586: Project 1

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*[2015-10-29 Thu]*

# 1 Hybrid Vector Clock algorithm

Consider the hybrid vector clocks (HVC) algorithm described in the course notes.

## 1.1 Write a TLA+ program to represent this algorithm.

You can write this in Pluscal and let TLA+ tool to translate this to TLA+. (You can study and learn from hlc.tla we shared on Piazza while writing the Pluscal algorithm for HVC.)

## 1.2 Model check safety properties with TLA+

- Write the corresponding safety properties for TypeOK and Sync in hlc.tla for the HVC algorithm.

- Write a safety property to check that vc.j.j >= pt.j and vc.j.j <= pt.j+ $\epsilon$.

- Write a safety property to check that always vc.j.j >= vc.k.j.

## 1.3 Tips

Using macros can be helpful. For example the SetMax (S) macro as used in hlc.tla can also help you here.

For sending messages, you can use the trick in hlc.tla. Or you can use the Send and Receive primitives described in the attached *network_simple.tla* file.

## 2   Bonus (10%)

If you can write the HVC algorithm to achieve flexible/reduced vector clock sizes, you will get 10% bonus.

For this, treating the vector clocks as a set of tuples, and using the "union" Pluscal/TLA primitive can be helpful.

You may also find it useful to write macros for vector clock entry pruning for a given physical time.

## 3   Submission

Your TLA+ file should be named "hvc.tla" (of course without the quotation marks, duh!). Your model's name should be the default name $Model\_1$ (do not name your model file differently).

Generate a pdf print of your TLA+ program using the "Produce Pdf version" from the TLA+ menu. (This will get included in your submission automatically.)

Now create a zip file from the ".tla" file and the corresponding ".toolbox" directory. **Name the zipfile as: proj1.zip**

Not following these directions will cause you to lose points.

You will use the submit command ($submit\_cse486$ or $submit\_cse586$ respectively) to submit your work. The submit command instructions are here: `https://wiki.cse.buffalo.edu/services/content/submit-script`