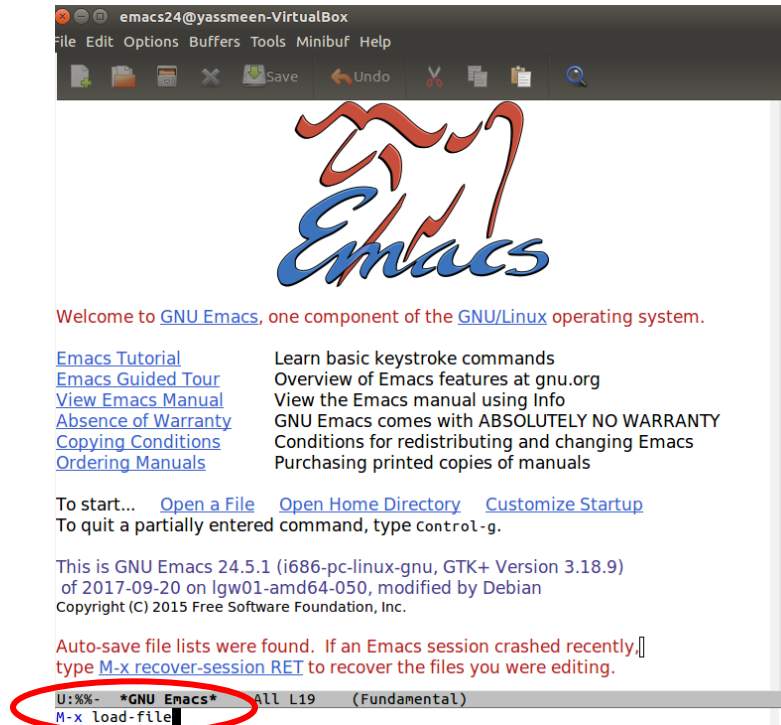


Note: an Oracle VM is used. The operating system of the machine is Ubuntu (32-bit)
Please follow the following steps to build the SEN theories:

- 1- Download a copy of hol-kananaskis-12.tar.gz from github (<https://github.com/HOL-Theorem-Prover/HOL/releases/tag/kananaskis-12>)
- 2- Follow the instructions in http://hvg.ece.concordia.ca/code/hol/SEN/scripts/HOL4_Installation.pdf
To install **GCC**, **PolyML 5.7** and **hol-kananaskis-12**.
- 3- Open Emacs and load the file “hol-mode.el” from HOL directory:

Example:

- Alt-x and type “load-file” then press enter.



- A cursor appears at the bottom, type the path: <HOL_Installation_Path>/tools/hol-mode.el , then press enter



Welcome to [GNU Emacs](#), one component of the [GNU/Linux](#) operating system.

[Emacs Tutorial](#) Learn basic keystroke commands
[Emacs Guided Tour](#) Overview of Emacs features at gnu.org
[View Emacs Manual](#) View the Emacs manual using Info
[Absence of Warranty](#) GNU Emacs comes with ABSOLUTELY NO WARRANTY
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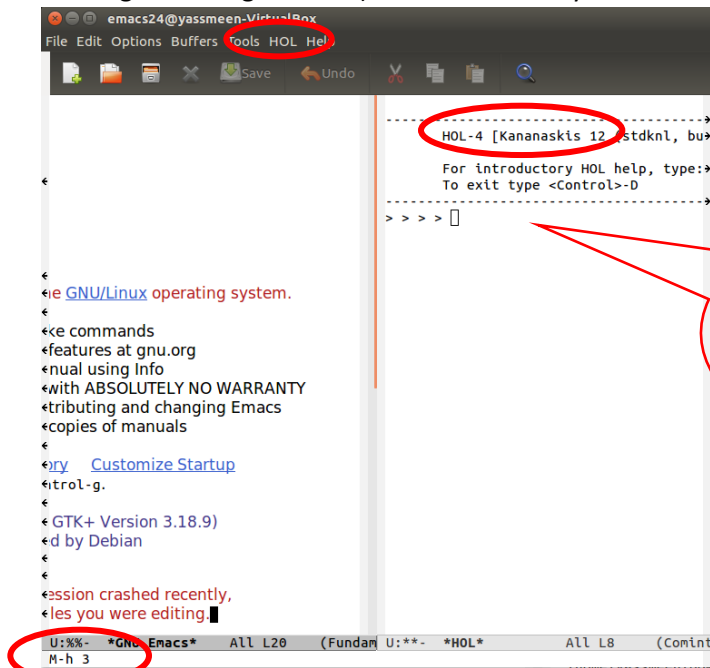
To start... [Open a File](#) [Open Home Directory](#) [Customize Startup](#)
To quit a partially entered command, type `Control-g`.

This is GNU Emacs 24.5.1 (i686-pc-linux-gnu, GTK+ Version 3.18.9)
of 2017-09-20 on Igw01-amd64-050, modified by Debian
Copyright (C) 2015 Free Software Foundation, Inc.

Auto-save file lists were found. If an Emacs session crashed recently,
type `M-x recover-session RET` to recover the files you were editing.

U:*** *GNU Emacs* ALL L20 (FundamenLaC)
Load file: ~/Downloads/hol-kananaskis-12/tools/hol-mode.el

- Press ALT-h 3 (it will split the Emacs window into two buffers and HOL shell will be running on the right buffer). Make sure that you see HOL in the menu bar



HOL shell is running on the right. Make sure you are running HOL4 K12

- More details about Emacs HOL commands can be found at: <https://hol-theorem-prover.org/hol-mode.html>

- 4- Download the following HOL Scripts from: <http://hvg.ece.concordia.ca/code/hol/SEN/index.php>.

- Required Theories
- DFT Theories
- DRBD Theories
- DFT DRBD_Theory
- SEN Theory

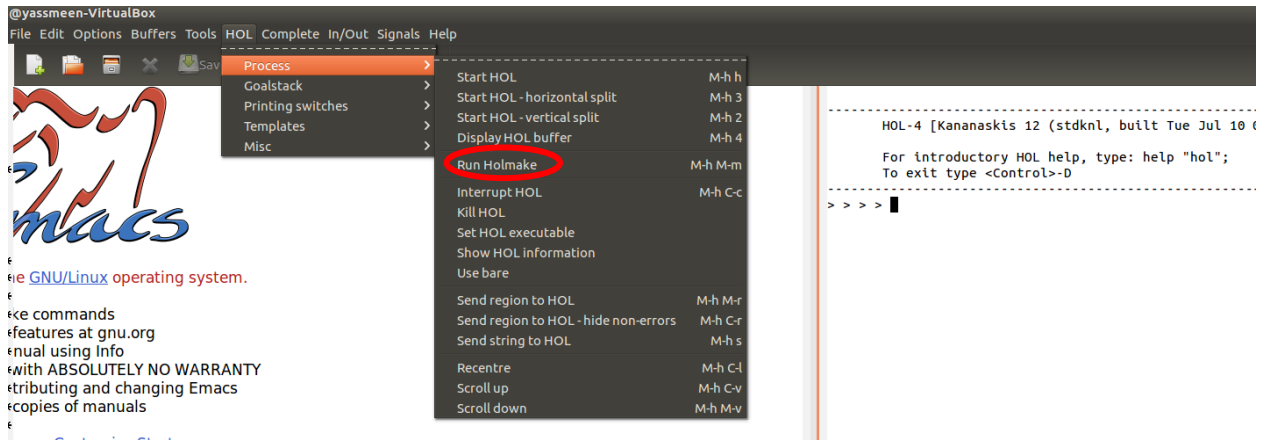
5- Extract the .zip files

6- In each of the theories directories (except Required-Theories), there is a Holmakefile. This file has a path to the directories that it needs. Update the paths to point to where you stored the directories. For example, DFT-Theories directory has Holmakefile that should point to the Required-Theories directory. This path should be updated to point to where the Required-Theories is extracted:

```
INCLUDES=/home/yassmeen/Downloads/Theories/Required-Theories
```

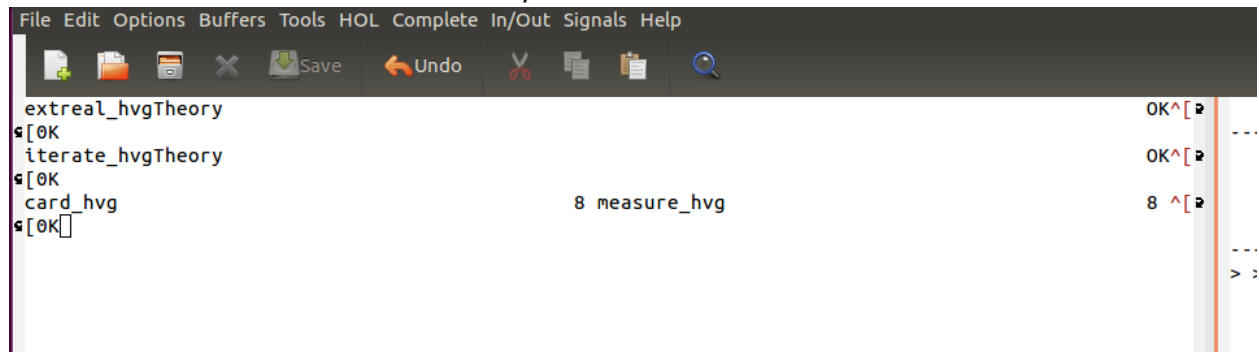
Repeat the same step with the rest of the directories. i.e., update the INCLUDES path.

7- From the HOL menu, choose Process then Run HOLmake



8- Go to the Required-Theories directory and click open

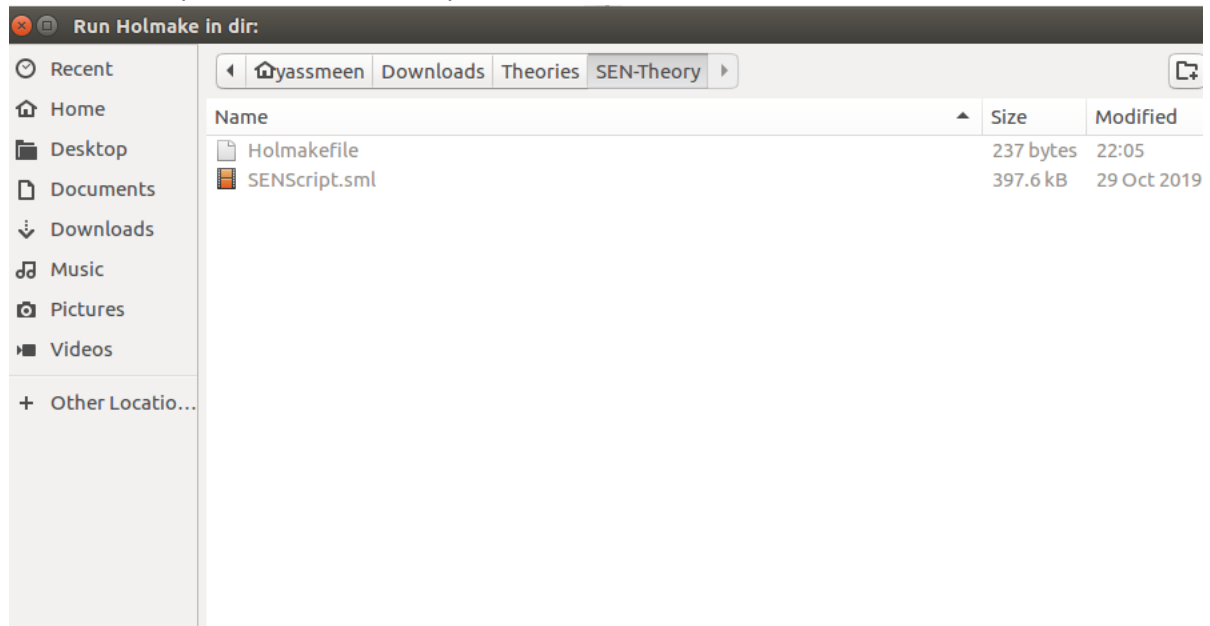
9- You should see the theories are built one by one:



10- Once Process Holmake finishes, repeat step 9 with the rest of the theories in the following order:

- DFT Theories
- DRBD Theories
- DFT-DRBD Theory
- SEN Theory

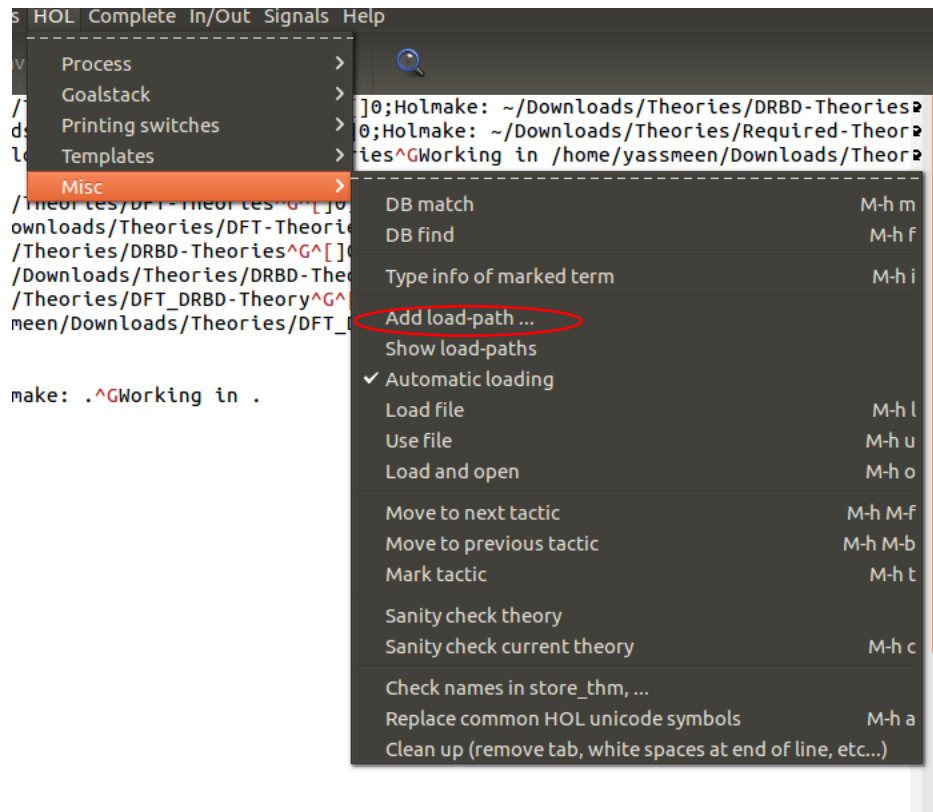
11- The last Theory to build is SEN Theory:



```
^[]0;Holmake: .^G^[]0;Holmake: .^GWorking in .
SENTheory
^[]0K
Process Holmake finished
```

OK^[]0

12- In order to load the theories, you need to load their paths. Go to HOL menu -> Misc-> Add load-path



- 13- Add the paths to all directories where you built the theories. To show the list of loaded paths: HOL -> Misc -> Show load-paths:

```
Current loadPath
-----
/home/yassmeen/Downloads/Theories/DFT_DRBD-Theory
/home/yassmeen/Downloads/Theories/SEN-Theory
/home/yassmeen/Downloads/Theories/DRBD-Theories
/home/yassmeen/Downloads/Theories/DFT-Theories
/home/yassmeen/Downloads/Theories/Required-Theories
/home/yassmeen/Downloads/hol-kananaskis-12/sigobj
```

Note: the path to HOL k12 is loaded by default.

- 14- Open all the theories in order to be able to show any theorem. In order to do that, open a new buffer in Emacs in the LHS buffer and add the following text in blue. Make sure you still see HOL buffer on the RHS.

```
open HolKernel Parse boolLib bossLib numLib unwindLib tautLib Arith prim_recTheory
combinTheory quotientTheory arithmeticTheory hrealTheory relaxTheory realTheory
realLib jrjUtils pairTheory seqTheory limTheory transcTheory listTheory mesonLib
boolTheory topologyTheory pred_setTheory util_probTheory optionTheory numTheory
sumTheory InductiveDefinition ind_typeTheory pred_setLib iterate_hvgTheory
card_hvgTheory product_hvgTheory topology_hvgTheory derivative_hvgTheory
integration_hvgTheory real_sigmaTheory extreal_hvgTheory measure_hvgTheory
lebesgue_hvgTheory probability_hvgTheory lebesgue_measure_hvgTheory
```

```
normal_rv_hvgTheory netsTheory PIE_EXTREALTheory integration_before_afterTheory
dep_rewrite DFT_Gates_def_PROBTheory WCSPTTheory DRBDTheory
rewrite_Rules_LemmasTheory Rewrite_RulesTheory
rich_listTheory DFT_DRBDTheory SENTTheory;
```

- 15- Highlight the text that you added to the new buffer then do: Ctrl-u Ctrl-u Alt-h Alt-r.
This should load all theories as shown below:

```
> *** 'Quiet declaration' now true ***
*** Globals.interactive now false ***
Loading iterate_hvgTheory
Loading card_hvgTheory
Loading product_hvgTheory
Loading topology_hvgTheory
Loading derivative_hvgTheory
Loading integration_hvgTheory
Loading extreal_hvgTheory
Loading measure_hvgTheory
Loading lebesgue_hvgTheory
Loading probability_hvgTheory
Loading lebesgue_measure_hvgTheory
Loading normal_rv_hvgTheory
Loading PIE_EXTREALTheory
Loading integration_before_afterTheory
Loading DFT_Gates_def_PROBTheory
Loading WCSPTTheory
Loading DRBDTheory
Loading rewrite_Rules_LemmasTheory
Loading Rewrite_RulesTheory
Loading DFT_DRBDTheory
Loading SENTTheory

*** Emacs/HOL command completed ***
```

- 16- If you know the theorem name, you can type it in the HOL buffer and the theorem will be displayed:

```
> DRBD_parallel_bigunion;
val it =  $\vdash \forall Y s. DRBD\_parallel\ Y\ s = bigunion\ Y\ s$ : thm
> █
```

- 17- To find theorem by names, you can use: Alt-h f
You can find the names of the theorems in
<http://hvg.ece.concordia.ca/code/hol/SEN/SENTTheory.pdf>
- 18- Use Alt-h m to search theorems by pattern.

Example: Show all theorems that has DRBD_event

```
Term to match on: DRBD_event █
```