## TASK 1  (PIPE tool)

Design a cruise control model in Petri Nets. To model the system follow the below instructions:

- merge the 7 sub-models (see figure on next page) into a single model
  - use the file with the sub-models, which is provided on the class web site
  - the model must behave as defined in the below transition and state definition tables
- after you merge the sub-models remember to model all remaining transitions shown in the transition table (the sub-models describe only selected behavior); useful hints follow:
  - look at rows in the transition table; when you simulate the model, for each state you will need as many enabled transitions as the number of transitions for this state in the table
  - look at columns in the transition table;  if a given input in the table is used to perform transition FROM multiple different states, that this input will be modeled by multiple transitions (each responsible for a different input state)
- make sure that your final PN model takes proper number of states
  - simulate, enumerate and verify the states using the software

**State definition table**

| State | Engine | CCS | Throttle | CCS maintains speed |
|-------|--------|-----|----------|---------------------|
| S1 | off | off | same | No |
| S2 | on | off | manual | No |
| S3 | on | on | same | Yes |
| S4 | on | on | increase | Yes |
| S5 | on | on | decrease | Yes |
| S6 | on | on | increase | No |
| S7 | on | on | decrease | No |

**State transition table**

| inputs<br>states | I1<br>Engine<br>ON | I2<br>Engine<br>OFF | I3<br>CCS<br>ON | I4<br>CCS<br>OFF | I5<br>pulses<br>above<br>desired<br>frequency | I6<br>pulses<br>below<br>desired<br>frequency | I7<br>pulses<br>at desired<br>frequency | I8<br>acceler<br>down | I9<br>brake | I10<br>increase<br>speed<br>for CCS | I11<br>decrease<br>speed<br>for CCS | I12<br>resume<br>CCS<br>control |
|------|----|----|----|----|----|----|----|----|----|----|----|----|
| S1 | S2 | – | – | – | – | – | – | – | – | – | – | – |
| S2 | – | S1 | S3 | – | – | – | – | – | – | – | – | – |
| S3 | – | – | – | S2 | S5 | S4 | – | S4 | S7 | S4 | S5 | – |
| S4 | – | – | – | S2 | S5 | – | S3 | – | S7 | S3 | S3 | – |
| S5 | – | – | – | S2 | – | S4 | S3 | S4 | S7 | S3 | S3 | – |
| S6 | – | S1 | – | S2 | – | – | – | – | S7 | – | – | S3 |
| S7 | – | S1 | – | S2 | – | – | – | S6 | – | – | – | S3 |

**SUBMISSION**

Each group must submit the result via email **at the end of the lab, by 16:50 at the LATEST.**

- **No extensions will be given!**
- Send the 7 sub-models and the model named "CCS_groupname.xml" in the PIPE format as an attachment to **chaari@ualberta.ca** and **panahand@ualberta.ca** .
- Attach also the screenshot of all your models.
- Enter the "ECE321: LAB 8 groupname " as the email subject.

**Remember to get confirmation that I received the email before the lab ends!**