CS_175: Modelling Computing Systems 2 **Exercise 3**
Due: Problem Session in Week 7 (Thursday 12 March 2020)

1. Consider the following process definition.

$$X \stackrel{\text{def}}{=} a.0 + a.Z \qquad Y \stackrel{\text{def}}{=} a.Z \qquad Z \stackrel{\text{def}}{=} a.Z$$

   (a) Draw the labelled transition system for the above process.

   (b) Explain in words how states X and Y differ, behaviourally.

2. Design a keypad lock which has three buttons labelled A, B and C. Any of the keys can be pressed at any time, and if the correct sequence of 5 key presses, namely BBCBA, is keyed in, then the lock will open.

   To solve this problem, do the following.

   - Let a, b and c be actions representing the actions of pressing buttons A, B and C, respectively; and *open* (and *close*) represent the action of opening (respectively closing) the lock.
   - Let S_n (for $0 \leq n \leq 5$) be state variables, with S_n representing the state in which the last n button presses were the first n buttons in the sequence of button presses which opens the lock. Thus, for example, after the sequence of button presses ABCBBC, the process should be in state S_3.
   - Give process definitions for each of the process variables S_n. As a start,

     $$S_0 \stackrel{\text{def}}{=} a.S_0 + b.S_1 + c.S_0$$

     That is, if the B button is pressed, then move to the state S_1 in which the first correct button has been pressed; if any other button is pressed, then stay in the state S_0 in which no correct button has been pressed.

     Don't forget to include the action *open* from state S_5 as well as the action *close* from the resulting state.
   - Draw the labelled transition system for this process.