Communicating Sequential Processes
Exercises 5: Sequential Composition and Semantics

Leila M. A. Silva

1. Write a CSP process to describe a sentence (of a given language) that consists of a noun clause followed by a predicate. A predicate is a verb followed by a noun clause. A verb is either *loves* or *hates.* A noun clause is an article followed by a noun. An article is either *a* or *the.* A noun is either *man* or *woman.* Give examples of possible sentences in this language.
2. Write a sequential process to model a purchasing process where initially the user chooses a product and after that he pays for it. The payment could be by cash, by card or by cheque.
3. A one-time stack accepts data along channel *in*. It continues to do this until the command *produce* occurs, after that all the data are output in reverse order. Write a CSP process to model the stack behaviour.
4. Show that *P*|~|*Q* is refined by *P* or *Q* considering the traces, failures and failures and divergence models.
5. Show that *a->b->STOP* is refined by *a->STOP* only when considering the traces model. Use the FDR tool to verify this fact.
6. Define a switching process *S* that inputs a pair of integers on channels *left0* and *left1*, outputs the smaller of them on *right0* and the larger on *right1*, and then recurses. Show how five switching processes can be used to sort (repeatedly) sequences of four integers input on (*left0, left1, left2, left3*) and output on (*right0, right1, right2, right3*). Can fewer than five processes be used? Justify your answer.