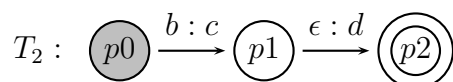
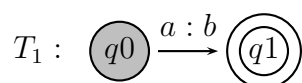




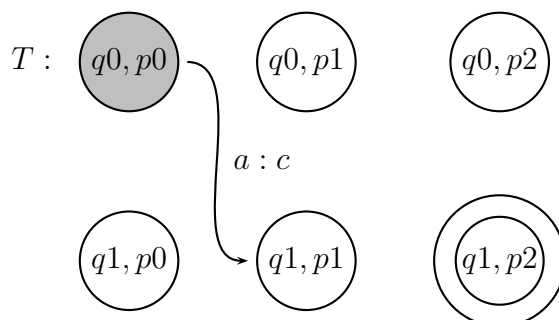
Challenge 2: Finite state technology

1

The construction of composition given in the lecture slides is flawed. Consider the relations $R_1 = \{\langle a : b \rangle\}$ and $R_2 = \{\langle b : cd \rangle\}$, trivially defined by the following transducers T_1 and T_2 , respectively:



Applying the definition given in class would yield the following transducer T for $R_1 \circ R_2$:



Clearly, the relation defined by T is empty, rather than the desired relation $\{\langle a : cd \rangle\}$.

1. Characterize the problem. Define precisely in what cases the given definition will not produce the correct results.
2. Solve the problem. Give a correct construction for transducer composition.

2

Re-do Challenge 1 in XFST. That is, define an XFST expression which maps Hebrew adjective base forms to their inflected forms in masculine singular, masculine plural, feminine singular and feminine plural.



3

The set of decimal numbers is obviously a regular language. The XFST expression

```
[ %0 | [1|2|3|4|5|6|7|8|9] [%0|1|2|3|4|5|6|7|8|9]* ]
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denotes the infinite set $\{0, 1, 2, \dots, 10, 11, \dots, 2005 \dots\}$. It excludes expressions with leading zeros such as 01. The corresponding set of numerals in English and in other languages is also a regular language. In English, this is:

{zero, one, two, ...ten, eleven, ...two thousand and
five, ...}

Your task is to define an XFST expression which maps each decimal number (up to one billion) to its counterpart(s) in Hebrew. This task is more elaborate than linking decimal numbers to their English representations due to the various expressions of numerals in Hebrew, in particular the variation on gender and status (construct/absolute). For this challenge, assume a single Hebrew numeral for each decimal number: the feminine absolute:

... אחת, שתיים, שלוש, ארבע, ... אחת עשרה, שתיים עשרה, ... אלפיים וחמש, ...

Then, download Lauri Karttunen's solution for English from:

<http://www.cis.upenn.edu/~cis639/assign/assign8.html>

Combine your solution with the English expression to create a translator of numerals from English to Hebrew and back.