Sample Exam Testing Techniques

We wish you a lot of success!

1 What is testing?

1. Describe the purpose of testing. *(2 points)*

2. In his guest lecture, Machiel van der Bijl presented how Axini uses model-based testing in practice. Describe their main reasons for using model-based testing. *(2 points)*

2 Blackbox Testing.

The C function *saved* calculates the total sum of money that results after saving for years a certain fixed amount per year with a fixed interest rate. More precisely, on Januari 1st of each year a certain amount `amount` is put in a bank account. Each year on December 31st, the bank sents out an account summary indicating the total amount of money in the account. The bank uses the function `saved` below to compute the total amount of money after `years` years of saving.

The three inputs must be greater than or equal to 0; the output is a real value (double in C).

```
double saved(int amount, double rate, int years)
{
  int j;
  double s;

  j = 1;
  s = amount * (1.0 + rate/100);

  do
  {
    s = (s + amount) * (1.0 + rate/100.0);
    j = j+1;
  }
  while (j<years);

  return s;
}
```

1. Give a formal specification for the function `saved` as pre- and postconditions, based on the informal description.
2. Use the equivalence partitioning technique to divide the input suitable equivalence classes.
3. Give a test set that covers all equivalence classes.
4. Extend the test set following the principle of boundary value analysis.
5. Which test cases from your test set in 4 does the implementation above pass?

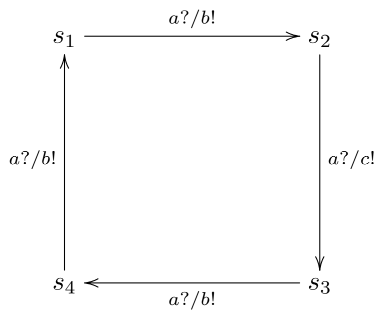

Figure 1: The FSM A; s_1 is initial.

3 FSM testing

1. Describe the notion of soundness for FSM testing.
2. Prove that the state tour method is sound.
3. Prove that the state tour method is not complete.
4. Use the transition test method to derive a test for the transition $s_2 \xrightarrow{a?/c!} s_3$. Describe the steps that you performed to obtain this test.

4 Proofs

We consider several transformations on QTSs. Are the statements below true? If so, give a proof otherwise give a counter example. We assume the following.

- Let I, I', P, Q, R be QTSs with label set $L = \langle L_I, L_U \rangle$.
- We assume that these do not contain any τ-transitions.
- We assume that I, I', P, R are input-enabled.

1. If $I \approx_{tr} I'$ and I $\mathbf{ioco}$ R, then I' $\mathbf{ioco}$ R.*(8 points)*
2. If P $\mathbf{ioco}$ Q, then $(\mathbf{hide}\ a\ \mathbf{in}\ P)$ $\mathbf{ioco}$ $(\mathbf{hide}\ a\ \mathbf{in}\ Q)$.
3. If $P \| R$ $\mathbf{ioco}$ $Q\|$, then $(P\|R)$ $\mathbf{ioco}$ $(P\|R)$.
4. Assume that p, q are input-enabled. If P $\mathbf{ioco}$ Q and q $\mathbf{ioco}$ P, then P and Q are isomorphic.

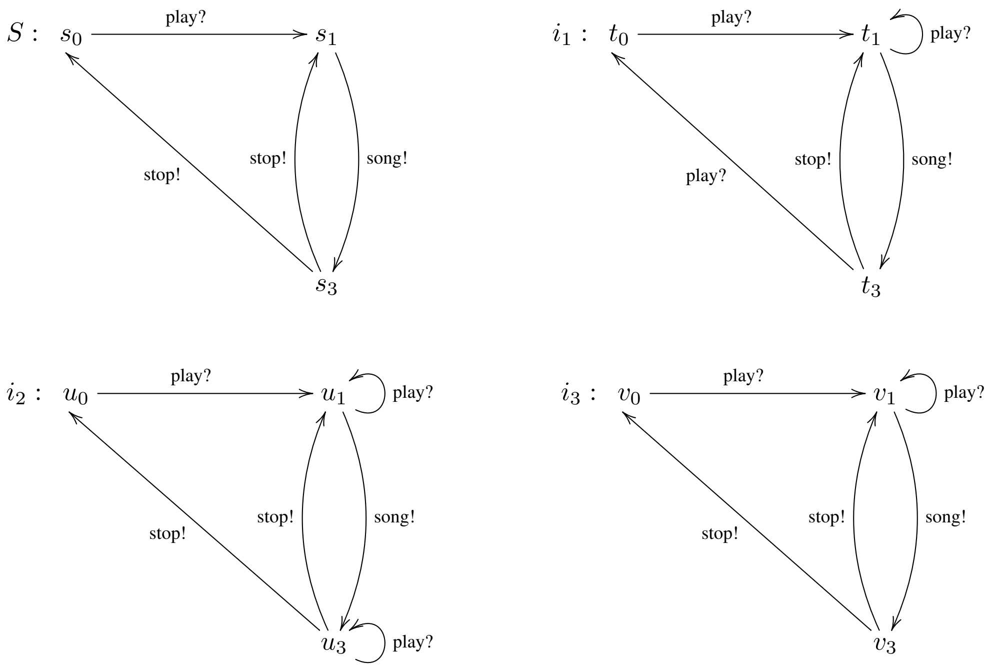

Figure 2: Transition systems S, i_1, i_2, and i_3; s_0, t_0, u_0, v_0 are initial states.

ioco

The specification S in Figure 2 represents a simplified specification of an MP3 player. After pushing the play button, a song is started. When the song is over, the MP3 player either moves to a state where it starts a new song, or (if the play list is finished), it stops playing and waits for the user to push the play button again.

1. If possible, give test suites with the following properties.
   (a) T_1 is sound wrt S and contains 3 test cases.
   (b) Prove that your test case T_1 is not complete for S.
   (c) T_2 is not sound.
   (d) T_3 is inconsistent.
2. Which of the IOLTSs i_1, i_2, i_3 in Figure 2 are ioco-correct implementations of S? If an implementation is incorrect provide a test case that fails on this implementation.
3. Are the following statements true or false? For a true statement give a proof, for a false statement, give a counter example.

(a) Suppose that we have a sound test suite for S. Suppose that we change one of the pass verdicts in a fail. Is the resulting test suite still sound?

(b) Suppose that we have a sound test suite for S. Suppose that we change one of the fail verdicts in a pass. Is the resulting test suite still sound?

(c) Suppose that we have a complete test suite for S. Suppose that we change one of the fail verdicts in a pass. Is the resulting test suite still sound?