The ASCII text of this coursework is online at http://nrg.cs.ucl.ac.uk/mjh/3c03/coursework1.txt to save you needing to type the models in yourself.

**Part 1 (30%)**

The FSP model below is supposed to model moving money backwards and forwards between two bank accounts. For the sake of modelling, we assume the accounts can hold a maximum of $4. Your account starts with $2, and my account starts empty. Use LTSA to help you figure out how what happens. Explain why you would not want to keep your money with this bank. Give an example of what can go wrong.

```plaintext
const Max = 4
ACCOUNT(I=0) = ACCOUNT[I],
ACCOUNT[i:0..Max] = { read[i] -> ACCOUNT[i]
                        | write[n:0..Max] -> ACCOUNT[n] }.

TRANSACTION = {from.read[i:0..Max] -> transfer[j:0..i] -> from.write[i-j] ->
                to.read[k:0..Max] -> to.write[k+j] -> TRANSACTION}.

||MOVEMONEY = {your:ACCOUNT(2) || my:ACCOUNT(0) ||
               a:TRANSACTION || b:TRANSACTION}/{{a.from.read,b.to.read}/your.read,
               {b.from.read,a.to.read}/my.read,
               {a.to.write,b.to.write}/my.write,
               {b.to.write,a.from.write}/your.write}.
```

continued overleaf...
Part 2 (30%)

In an attempt to fix the problems from Part 1, the bank’s systems analyst changes the FSP model to that shown below. Explain how this prevents your example of unintended behaviour from part 1 from happening.

The change has an unintended consequence – explain with the aid of an example why you still wouldn’t want to bank with this bank.

```plaintext
const Max = 4
ACCOUNT(I=0) = ACCOUNT[I],
ACCOUNT[i:0..Max] = { read[i] -> ACCOUNT[i]
    | write[n:0..Max] -> ACCOUNT[n]}. 
LOCK = (lock -> unlock -> LOCK).

TRANSACTION = (from.lock -> to.lock ->
    from.read[i:0..Max] -> transfer[j:0..i] -> from.write[i-j] ->
    to.read[k:0..Max] -> to.write[k+j] ->
    from.unlock -> to.unlock -> TRANSACTION).

||MOVEMONEY = (your:ACCOUNT(2) || my:ACCOUNT(0) ||
your:LOCK || my:LOCK ||
a:TRANSACTION || b:TRANSACTION)
  //{{a.from.read,b.to.read}/your.read,
  {b.from.read,a.to.read}/my.read,
  {a.to.write,b.to.write}/my.write,
  {b.to.write,a.from.write}/your.write,
  {a.from.unlock,b.to.lock}/your.lock,
  {a.from.unlock,b.to.unlock}/your.unlock,
  {a.to.lock,b.from.lock}/my.lock,
  {a.to.unlock,b.from.unlock}/my.unlock}.
```

Part 3 (40%)

Re-write the FSP model to avoid both these unintended behaviours (and without adding any additional unintended behaviour).