Tik-79.144 **Syksy 1999**
Logic in Computer Science: Foundations
Exercise 11
Solutions

1. First we write an input file:

```
set(binary_res). % select resolution strategy

formula_list(sos).
(all x (p(x) -> q(x))).
(all x (-r(x) -> -q(x))).
-(all x (p(x) -> r(x))).
end_of_list.
```

The `otter` translates the sentences into clausul form:

```
-------> sos clausifies to:
list(sos).
1 [] -p(x)|q(x).
2 [] r(x)| -q(x).
3 [] p($c1).
4 [] -r($c1).
end_of_list.
```

Next `otter` presents the proof:

```
---------------- PROOF ----------------
1 [] -p(x)|q(x).
2 [] r(x)| -q(x).
3 [] p($c1).
4 [] -r($c1).
5 [binary,1.1,3.1] q($c1).
6 [binary,2.1,4.1] -q($c1).
7 [binary,6.1,5.1] $F.
------------ end of proof -------------
```

2. Write the input file `monkey.otr`:

```
% Monkey example

set(binary_res).            % Resoluutiostrategia
assign(max_mem, 1500).      % 1.5 MB
```

```
assign(max_seconds, 1800).  % 30 min
set(free_all_mem).

formula_list(sos).

(all x (close(m,x) -> reach(m,x))).
(all x ((tall(x) & on(m,x) & under(x,b)) -> close(m,b))).
tall(c).
climb(m,c).
(all z moves(m,c,z)).
(all x (climb(m,x) -> on(m,x))).
(all x (all y (all z (moves(x,y,z) ->
         (close(y,z) | under(y,z)))))).
-close(c,b).
-(exists x reach(m,x)).

end_of_list.
```

Start the program with command `otter < monkey.otr > monkey.out`
The output file contains first the clausul form of the sentences.

```
list(sos).
1 [] -close(m,x) | reach(m,x).
2 [] -tall(x) | -on(m,x) | -under(x,b) | close(m,b).
3 [] tall(c).
4 [] climb(m,c).
5 [] moves(m,c,z).
6 [] -climb(m,x) | on(m,x).
7 [] -moves(x,y,z) | close(y,z) | under(y,z).
8 [] -close(c,b).
9 [] -reach(m,x).
end_of_list.
```

Next there is a binary resolution proof of the claim:

```
1 [] -close(m,x) | reach(m,x).
2 [] -tall(x) | -on(m,x) | -under(x,b) | close(m,b).
3 [] tall(c).
4 [] climb(m,c).
5 [] moves(m,c,z).
6 [] -climb(m,x) | on(m,x).
7 [] -moves(x,y,z) | close(y,z) | under(y,z).
8 [] -close(c,b).
9 [] -reach(m,x).
```

```
10 [binary,1,9] -close(m,x).
11 [binary,6,4] on(m,c).
12 [binary,7,5] close(c,x) | under(c,x).
15 [binary,12,8] under(c,b).
17 [binary,2,11] -tall(c) | -under(c,b) | close(m,b).
24 [binary,17,15] -tall(c) | close(m,b).
26 [binary,24,3] close(m,b).
27 [binary,26,10] .
```