Formal Models for
Parallel and Distributed Systems
Exercise 4 (February 5)

Wolfgang Schreiner
Wolfgang.Schreiner@risc.uni-linz.ac.at

January 9, 2007

The exercise is to be submitted by **February 5** (hard deadline)

1. as a single PDF file sent to me per email, or

2. as a paper report (cover page with full name and Matrikelnummer, pages stapled) addressed to "Wolfgang Schreiner, Research Institute for Symbolic Computation (RISC)" and put into a university mailbox.

π-Calculus

1. Read Robin Milner's Turing Award lecture "Elements of Interaction" and answer the following questions:

   (a) What key differences does Milner see between a calculus for sequential programs and one for concurrent systems?

   (b) What differences/relationships between the λ-calculus and the π-calculus does Milner mention?

2. Construct a π-calculus model of the client/server system of Exercise 1 with the following modifications:

   (a) The server receives messages by a single input port *server* public to all clients.

   (b) A client sends as a request a secret port name *client* at which it expects the answer to its request.

   (c) The resource maintained by the server is an active process with a secret port *newclient* shared between server and resource.

   (d) When the server answers a request, it creates a secret port name *resource* and forwards this name to both the resource process (via *newclient*) and the client (via *client*).

1

(e) The client may use the resource by sending an arbitrary number of messages to *resource* which are correspondingly received by the resource process.

(f) If a client is done with the resource, it sends a message to *server*.

Please be aware that port names are to be kept as secret as possible (new port names have to be generated for every request).

You may assume a process expression `if` $x=y$ `then` P_1 `else` P_2 which compares two port names x and y and then proceeds, depending on the result, either with P_1 or with P_2.