Homework 8:

CHP

Homework is due in class on the date indicated above. Late homeworks will be penalized by weighting errors on those problems that were completed past the due date by the number of days past the due date plus an extra 5% per day. Please indicate which problems, if any, took extra time.

1. CHP programs Translate the following CHP programs into your favorite programming language:

   \[
   P1 \equiv \ast[[A \rightarrow S_1] \\
   [B \rightarrow \ast[C \rightarrow S_2]] \\
   ]; \\
   S_3 \\
   ] \\
   \]

   \[
   P2 \equiv \ast[[A \rightarrow S_1] \\
   [B \rightarrow [C \rightarrow S_2 \mid \neg C \rightarrow S_3]] \\
   ] \\
   \]

   Note: for problems 2 and 3, please do not use any communication actions other than send and receive.

2. Adder Stage We would like to implement a simple binary adder. One stage of an adder can be described by a process with three boolean input channels \( A, B, \text{Cin} \), and two boolean output channels \( S \) and \( \text{Cout} \). The stage reads in one bit from each input channel and adds the three bits together to produce a two bit result. The least significant bit of the result is sent out on channel \( S \), and the most significant bit is sent out on channel \( \text{Cout} \). Write a CHP description of the adder stage. (The adder stage should repeat the described behaviour indefinitely.) Note that this process structure can be used to compute any boolean function with three inputs and two outputs.

3. Palindrome Recognizer A palindrome is a sequence of numbers which is identical if read from back to front. For instance, each of the following three sequences is a palindrome:

   \[
   3 \\
   1 \ 9 \ 1 \\
   1 \ 9 \ 1 \ 1 \ 9 \ 1 \\
   \]

   i. Design a distributed program that recognizes palindromes. Suppose that the environment is connected to the palindrome recognizer with ports \( p \) and \( \text{answ} \) (you may change the names). The environment repeatedly does

   \[
   p!x; \ \text{answ}?a \\
   \]

   where \( a \) should be 1 if the sequence of \( x \) values that is input so far is a palindrome, and 0 otherwise. For instance, confronted with the sequence of \( x \) values \( 1 \ 9 \ 1 \ 1 \ 9 \ 1 \), your recognizer should produce the following sequence of \( a \) values: \( 1 \ 0 \ 1 \ 0 \ 0 \ 1 \)

   You can restrict the maximum length of sequences. Your recognizer should not use arrays or linked lists of integers. Rather, the number of processes should be proportional to the maximum length of the input sequence.

   If you want, you can make the environment start with \( \text{answ}?a \) instead of \( p!x \). In other words the environment will first query whether the empty string is a palindrome.

   ii. The response time is the latency in time between the sending of an input to the palindrome recognizer and the receiving of the associate output. Make your recognizer have a constant response time.