COMPUTER SCIENCE TRIPOS Part IA − 2012 − Paper 1

2 Foundations of Computer Science (LCP)

(a) Write brief notes on `fn`-notation and curried functions in Standard ML. Illustrate your answer by presenting the code for a polymorphic curried function `replicate`, which given a non-negative integer n and a value x, returns the list $[\underbrace{x, \ldots, x}_{n}]$.   [6 marks]

(b) Write brief notes on references in Standard ML. Illustrate your answer by discussing (with the aid of a diagram) the effect of the following two top-level declarations:

```
val rlist = (replicate 4 (ref 0)) @ (map ref [1, 2, 3, 4]);
val slist = map (fn r => ref (!r)) rlist;
```

[6 marks]

(c) The following three lines are typed at the ML top level, one after the other. What value is returned in each case? Justify your answer clearly. [*Note:* Recall that an expression of the form $v := E$ has type `unit`.]

```
map (fn r => (r := !r + 1)) rlist;
map (fn r => (r := !r - 1; !r)) rlist;
map (fn r => (r := !r +3; !r)) slist;
```

[8 marks]

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