Programming with Patterns (31050 and 32050)
Laboratory exercises: Week 7

Question 1 Define append of lists by pattern-matching:

- appending a Nil list to a list ys yields ys
- appending Cons x xs is to append xs and then Cons x.

Check your answer by appending [1,2,3] and [4,5,6,7] and appending [[1,2,3],[]] and [[4,5], [6,7,8]]

Question 2 Define a function filter such that filter f xs produces the sublist of xs of those entries x of xs such that f x is True. For example,

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filter (fun x -> x/ 2 == 0) [1,2,3,4,5]
```

produces [2,4] and

```
filter (fun x -> x != []) [[1,2,3], [], [5,6], []]
```

produces [[1,2,3], [5,6]]

Question 3 Define a datatype

Datatype Btree a = Leaf of a — Node of Btree a and Btree a;;

of binary trees. Define mapTree, foldleftTree and foldrightTree by analogy with mapTree, etc defined in the lecture. Check your answers.

Question 4 Define the generic iterator that takes a function f, and integer n and an argument x and produces f (f ...(f x)) where f has been applied n times.

What is its type?

How can this be used to define a type N of natural numbers, analogous to the way that product types were defined in class?

Question 5 Describe a possible project that you might attempt for the assignment (worth 40% of your final mark). It could be an appli- cation of the new polymorphism. It could be an idea to improve bondi itself.