

THE UNIVERSITY OF AUCKLAND

FIRST SEMESTER, 2019

Campus: City

COMPUTER SCIENCE

Web, Mobile and Enterprise Computing

MOCK EXAM – JUST APPENDIX

(Time Allowed: TWO hours)

NOTES: Attempt all questions.

Marks for all questions total 70.

This exam counts for 70% of your final grade.

Write as clearly as possible.

The appendix recalls a few definitions and samples based on the standard F# core library – you can use them in your answers, as appropriate.

1. [18 marks] **Part I**
2. [12 marks] **Part I**
3. [14 marks] **Part I**

4. [6 marks] **Part II**
5. [8 marks] **Part II**
6. [12 marks] **Part II**

APPENDIX

Basic list monad functions

```

let unit t = [t]

let bind g m = m |> List.collect g

let map h m = m |> List.map h

let flat m2 = List.concat m2

```

Monad builder type and instance

```

type MU () =

  member this.Return (t) = unit t

  member this.ReturnFrom (m) = m // id m

  member this.Bind (m, g) = bind g m

let  $\mu$  = MU () // new

```

Sample translations from sugared expressions to monad builder member functions

```

let s x =  $\mu$  { return! x }

let s' x =  $\mu$ .ReturnFrom x

```

Kleisli operators

```

let (>>=) m f = m |> (bind f)

let (>=>) f g = f >> (bind g)

```

