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COURSE: COMP3007 - Programming Paradigms

SEMESTER: Fall 2018

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Assignment 1 - Question 2

Question 2: "Beta Reduction"

(3.5 marks)

If the LAST DIGIT of your student number is 1, 2, or 3, then use the following expression:

$$(\lambda a. \lambda b. (\lambda c. \lambda d. \lambda e. c \ d \ e) \ a \ b \ (\lambda f. (\lambda g. f))) \ (\lambda h. (\lambda i. h)) \ (\lambda j. (\lambda k. j))$$

If the LAST DIGIT of your student number is 4, 5, or 6, then use the following expression:

$$(\lambda a. \lambda b. (\lambda c. \lambda d. \lambda e. c \ d \ e) \ a \ b \ (\lambda f. (\lambda g. f))) \ (\lambda h. (\lambda i. h)) \ (\lambda j. (\lambda k. k))$$

If the LAST DIGIT of your student number is 7, 8, 9, or 0, then use the following expression:

$$(\lambda a. \lambda b. (\lambda c. \lambda d. \lambda e. c \ d \ e) \ a \ b \ (\lambda f. (\lambda g. f))) \ (\lambda h. (\lambda i. i)) \ (\lambda j. (\lambda k. j))$$

For this question, you must perform a β -reduction on whichever of the above expressions corresponds to the LAST DIGIT of your student number. Each of these is VERY SIMILAR to some of the in-class examples that can be found in the lecture notes entitled " λ -Calculus as a Programming Language", starting on slide 31.

Not counting the initial expression, each of the above can be β -reduced in exactly 7 steps. SHOW EVERY STEP. You will know you have finished when your expression is reduced to something of the form $(\lambda \blacksquare. (\lambda \blacksquare. \blacksquare))$, at which point you will not be able to reduce the expression further.

If the LAST DIGIT of your student number is 4, 5, or 6, then use the following expression:

$$\left(\lambda a. \lambda b. (\lambda c. \lambda d. \lambda e. c \ d \ e) \ a \ b \ (\lambda f. (\lambda g. f)) \right) (\lambda h. (\lambda i. h)) (\lambda j. (\lambda k. k))$$

$$\left(\lambda a. \lambda b. (\lambda c. \lambda d. \lambda e. c \ d \ e) \ a \ b \ (\lambda f. (\lambda g. f)) \right) (\lambda h. (\lambda i. h)) (\lambda j. (\lambda k. k))$$

$$\left(\lambda b. (\lambda c. \lambda d. \lambda e. c \ d \ e) \ (\lambda h. (\lambda i. h)) \ b \ (\lambda f. (\lambda g. f)) \right) (\lambda j. (\lambda k. k))$$

$$(\lambda c. \lambda d. \lambda e. c \ d \ e) (\lambda h. (\lambda i. h)) (\lambda j. (\lambda k. k)) (\lambda f. (\lambda g. f))$$

$$(\lambda d. \lambda e. (\lambda h. (\lambda i. h)) \ d \ e) (\lambda j. (\lambda k. k)) (\lambda f. (\lambda g. f))$$

$$(\lambda e. (\lambda h. (\lambda i. h)) (\lambda j. (\lambda k. k)) \ e) (\lambda f. (\lambda g. f))$$

$$(\lambda h. (\lambda i. h)) (\lambda j. (\lambda k. k)) (\lambda f. (\lambda g. f))$$

$$(\lambda i. (\lambda j. (\lambda k. k))) (\lambda f. (\lambda g. f))$$

$$\lambda j. (\lambda k. k)$$

Assignment 1 - Question 3

If the 2nd LAST DIGIT of your student number is 7, 8, 9, or 0, then trace the evaluation of:

`secret (puzzle (enigma 3 5) 7) 9`

secret (puzzle (enigma 3 5) 7) 9

secret (puzzle (3 - 5) 7) 9

*secret ((3 - 5) * 7) 9*

*9 - ((3 - 5) * 7)*

*9 - (-2 * 7)*

9 - (-14)

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