

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

PILANI CAMPUS

FIRST SEMESTER 2020 – 2021

PRINCIPLES OF PROGRAMMING LANGUAGES (CS F301)

Tutorial (30th October 2020)

- 1) We have studied about AND combinator. Using the knowledge, how will you simulate the NOT, OR and Binary Equality using combinators in lambda calculus.
- 2) Evaluate
 - a) $3+5$
 - b) $5*2$
 - c) $(\lambda g . g\ 5)\ (\lambda x . (\text{add } x\ 3))$
- 3) Correctly parenthesize each of these lambda expressions
 - a) $(\lambda x . x)\ (\lambda y . y)\ \lambda x . x\ (\lambda y . y)\ z$
 - b) $\lambda x . x\ \lambda y . y\ \lambda z . z\ \lambda w . w\ z\ y\ x$
- 4) Find the set of free variables for each of the following lambda expressions:
 - a) $(\lambda x . x\ y)\ \lambda z . w\ \lambda w . w\ z\ y\ x$
 - b) $\lambda x . x\ y\ \lambda x . y\ x$