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Jing Xi (jxi2@ncsu.edu), Department of Mathematics, North Carolina State University, 3250 SAS Hall, Raleigh, NC 27695, **Jin Xie*** (jin.xie@uky.edu), Department of Statistics, University of Kentucky, 725 Rose St MDS Room 338, Lexington, KY 40506, and **Ruriko Yoshida** (ruriko.yoshida@uky.edu), Department of Statistic, University of Kentucky, 725 Rose St MDS Room 325D, Lexington, KY 40506. *Distributions of topological tree metrics between a species tree and a gene tree.*

In order to conduct a statistical analysis on a given set of phylogenetic gene trees, we often use a distance measure between two trees. In a statistical distance-based method to analyze discordance between gene trees, it is a key to decide “biological meaningful” and “statistically well-distributed” distance between trees. Thus, in this paper, we study the distributions of the three tree distance metrics: the edge difference, the path difference, and the precise K interval cospeciation distance, between two trees: First, we focus on distributions of the three tree distances between two random unrooted trees with n leaves ($n \geq 4$); and then we focus on the distributions the three tree distances between a fixed rooted species tree with n leaves and a random gene tree with n leaves generated under the coalescent process with given the species tree. We show some theoretical results as well as simulation study on these distributions. (Received August 10, 2015)