Question 1: Nested logit

Consider the red bus/blue bus example that has been seen during the lectures. Travelers initially face a decision among three alternatives: car, blue bus and red bus. Travel time is the only variable considered in the utility functions and is equal for all alternatives.

Assume that the error terms for the red and blue bus are correlated and that the correlation is 95%. Consider a nested logit model where both bus alternatives are in one nest, and the car alternative is in another nest.

1. What is the value of the scale parameters μ (associated with the choice across nests) and μ_{bus} (associated with the choice within the nest "bus")?

2. What is the choice probability of each alternative given by the model?

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Question 2: Cross-nested logit

Consider the cross-nested logit model whose nesting structure is represented in Figure 1. Let a_i, $i = 1, \ldots, 5$ be the node representing alternative i and n_m, $m = 1, 2, 3$ be the node representing nest m. Let μ_m be the scale parameter of nest m, and α_{im} be the membership parameter of alternative i to nest m. The scale parameter μ is normalized to 1.
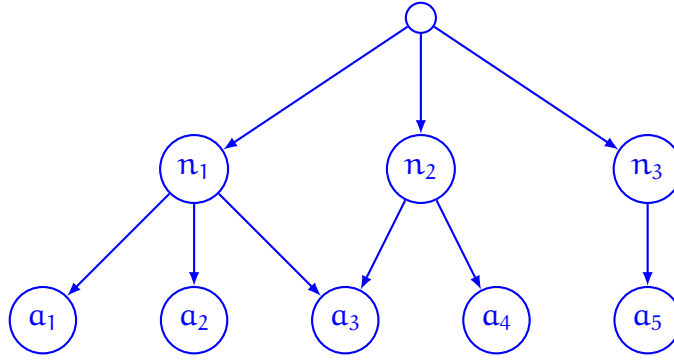

Figure 1: Cross-nested structure.

1. The value of some α_{im} and μ_m is known and does not need to be estimated. List all those parameters, mention their value, and explain why they do not need to be estimated. Give an exhaustive list.

2. What properties must the estimated μ_m verify in order to be consistent with random utility?

3. What properties must the estimated α_{im} verify to be consistent with random utility?

4. What is the probability generating function of this MEV model?