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HOMEWORK WEEK 4 (Solution)

In a route choice case study, the utility functions are defined as follows:

$$\begin{aligned}U_1 &= ASC_1 + \beta_{length} \cdot length_1 + \varepsilon_1 \\U_2 &= ASC_2 + \beta_{length} \cdot length_2 + \varepsilon_2\end{aligned}\tag{1}$$

where alternatives 1 and 2 represent different routes,  $ASC_1$ ,  $ASC_2$  and  $\beta_{length}$  are parameters to be estimated and  $length_i, i \in \{1, 2\}$  is the length of each route in kilometers.

The estimation results of a binary logit model, where  $ASC_1$  has been normalized to zero, are shown in the first column of the following table. The second column corresponds to the same specification where  $ASC_2$  has been normalized to zero:

	Logit 1	Logit 2
$ASC_1$	0	x
$ASC_2$	-2	0
$\beta_{length}$	10	y

Perform the following tasks:

1. Replace  $x$  and  $y$  in the table by the value of the corresponding parameter.

**Solution:**  $x = 2, y = 10$ .

2. What are the distributions of  $\varepsilon_1, \varepsilon_2$  and  $\varepsilon_1 - \varepsilon_2$ ?

**Solution:**  $\varepsilon_1, \varepsilon_2$  are the extreme value distributions:  $\varepsilon_1 \sim EV(0, \mu), \varepsilon_2 \sim EV(0, \mu)$ , which are independent with the same scale parameter  $\mu$  (i.i.d.);  $\varepsilon_1 - \varepsilon_2$  follows a logistic distribution:  $\varepsilon_1 - \varepsilon_2 \sim \text{Logistic}(0, \mu)$ .