Problem Set 5 Solution

Instructor : Yujung Hwang *

October 9, 2020

Question 1.

(a)

```
> coef(oout)  # estimate
[1] 0.3080911 5.1336746
> stdEr(oout) # standard error
[1] 0.009924786 0.127096105
```

(b)

```
> coef(oout)  # estimate
[1] 0.3044062 5.0667203
> stdEr(oout) # standard error
[1] 0.01604319 0.07813442
```

(c)

```
> coef(oout)  # estimate
[1] 0.3089259 5.2111210
> stdEr(oout) # standard error
[1] 0.01601892 0.07811093
```

Question 2.

By taking the derivative w.r.t. θ,

$$0 = \sum_n \sum_s \frac{1}{\sum_{s'=1}^{S} \pi_{s'} \Pi_{t=1}^{T} \mathscr{L}_{nis't}(\theta)} \left(\sum_{t'} \pi_{s'} \Pi_{t \neq t'} \mathscr{L}_{nis't}(\theta)\right) \frac{\partial \mathscr{L}_{nis't}}{\partial \theta} \tag{0.1}$$

Note that

$$\frac{\partial \log \mathscr{L}_{nis't}}{\partial \theta} = \frac{1}{\mathscr{L}_{nis't}} \frac{\partial L_{nis't}}{\partial \theta} \tag{0.2}$$

*yujungghwang@gmail.com

Pluging equation 0.2 into 0.3, we obtain

$$0 = \sum_n \sum_s \underbrace{\frac{\pi_s \Pi_{t=1}^T \mathscr{L}_{nst}(\theta)}{\sum_{s'=1}^S \pi_{s'} \Pi_{t=1}^T \mathscr{L}_{ns't}(\theta)}}_{=q_{ns}\text{prob of ind n of being type s}} \left(\frac{\sum_{t'} \partial \ln \mathscr{L}_{nst'}}{\partial \theta} \right) \tag{0.3}$$

Question 3.

```
> coef(oout)  # estimate
[1] 0.09489552 4.03155725
> stdEr(oout) # standard error
[1] 0.001865697 0.014965900
```