$$\ell = \sum_{u} \sum_{v} \#Sample \cdot Sim_{u}(v) \cdot (log\sigma(\vec{s_{u}} \cdot \vec{t_{v}}))$$

$$+ \frac{k}{|V|} \sum_{n} log\sigma(-\vec{s_{u}} \cdot \vec{t_{n}}))$$

$$= \#Sample\{\sum_{v} \sum_{v} Sim_{u}(v) \cdot log\sigma(\vec{s_{u}} \cdot \vec{t_{v}})\}$$

$$+\sum_{u}\sum_{n}\sum_{v}Sim_{u}(v)\cdot\frac{k}{|V|}\cdot log\sigma(-\vec{s_{u}}\cdot\vec{t_{n}})\}$$

$$= \#Sample\{\sum_{u} \sum_{v} Sim_{u}(v) \cdot log\sigma(\vec{s_{u}} \cdot \vec{t_{v}})\}$$

$$+\sum_{u}\sum_{n}\frac{k}{|V|}\cdot log\sigma(-\vec{s_{u}}\cdot\vec{t_{n}})\}$$

$$= \#Sample\{\sum \sum_{u} Sim_{u}(v) \cdot log\sigma(\vec{s_{u}} \cdot \vec{t_{v}})\}$$

$$= \#Sample\{\sum_{u}\sum_{v}(Sim_{u}(v) \cdot log\sigma(\vec{s_{u}} \cdot \vec{t_{v}})\}$$

 $+\frac{k}{|V|} \cdot log\sigma(-\vec{s_u} \cdot \vec{t_v}))\}$