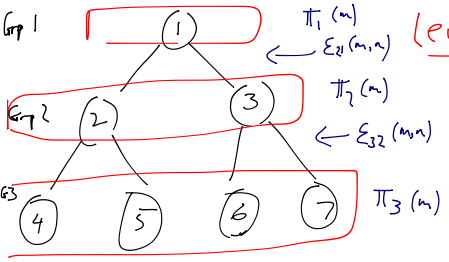


level by level grouping: no issue

$\pi_i(n) = P(\gamma_i = n \mid \underline{\theta}^{(t)})$

$\varepsilon_{i,p(i)}(m,n) = P(\gamma_i = n \mid \gamma_{p(i)} = n, \underline{\theta}^{(t)})$

for group i, and 'parent group', $p(i)$.

For ε, Y/hoods and Lagrangians derive to:

$$\varepsilon_{i,p(i)}(m,n) = \frac{\sum_{j \in i} P(\gamma_j = m, \gamma_{p(j)} = n \mid \underline{y}, \underline{\theta}^{(t)})}{\sum_{j \in i} P(\gamma_{p(j)} = n \mid \underline{y}, \underline{\theta}^{(t)})}$$

$$= \frac{1}{|i|} \times \frac{1}{\underbrace{\pi_{p(i)}(n)}_{=\pi_2(n)}} \times \sum_{j \in i} P(\gamma_j = m, \gamma_{p(j)} = n \mid \underline{y}, \underline{\theta}^{(t)})$$

(as per Couse)

Take group 3, for example.

$i = 4, \ldots, 7$

$p(i) = 2, 2, 3, 3$

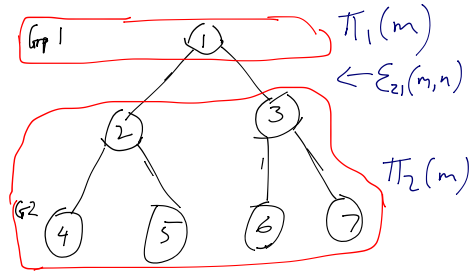
$\Rightarrow \sum_{i=4}^{7} P(\gamma_{p(i)} = n \mid \underline{y}, \underline{\theta}^{(t)})$

$= 2\left(P(\gamma_2 = n \mid \underline{y}, \underline{\theta}^{(t)}) + P(\gamma_3 = n \mid \underline{y}, \underline{\theta}^{(t)})\right)$

$= 4 \times \left(\frac{1}{2}\left[P(\gamma_2 = n \mid \underline{y}, \underline{\theta}^{(t)}) + P(\gamma_3 = n \mid \underline{y}, \underline{\theta}^{(t)})\right]\right)$

$= 4 \times \pi_2(n)$ (as defined in Couse. plus I think I've verified it on my own)

No issue as all nodes in group 3's parents are tied together to same param, π_2.



Multi-level groups: ISSUE

For ε, Y/hoods and Lagrangians derive to:

$$\varepsilon_{i,p(i)}(m,n) = \frac{\sum_{j \in i} P(\gamma_j = m, \gamma_{p(j)} = n \mid \underline{y}, \underline{\theta}^{(t)})}{\sum_{j \in i} P(\gamma_{p(j)} = n \mid \underline{y}, \underline{\theta}^{(t)})}$$

$$\neq \frac{1}{|i|} \times \frac{1}{\pi_{p(i)}(n)} \times \sum_{j \in i} P(\gamma_j = m, \gamma_{p(j)} = n \mid \underline{y}, \underline{\theta}^{(t)})$$

(as per Couse)

Take group 2, for example.

$i = 2, \ldots, 7$

$p(i) = 1, 1, 2, 2, 3, 3$

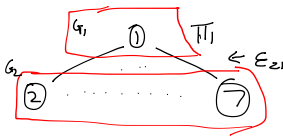
$\Rightarrow \sum_{i=2}^{7} P(\gamma_{p(i)} = n \mid \underline{y}, \underline{\theta}^{(t)})$

$= 2\left[P(\gamma_1 = n \mid \underline{y}, \underline{\theta}^{(t)}) + P(\gamma_2 = n \mid \underline{y}, \underline{\theta}^{(t)}) + P(\gamma_3 = n \mid \underline{y}, \underline{\theta}^{(t)})\right]$

$\neq \underbrace{|i|}_{=6} \times \pi_1(n)$, as required in Couse.

also, $\pi_i(n) \neq \pi_{p(i)}(n)$, for all i.

Issue, as $p(i) \neq i$, $\forall i = 2, \ldots, 7$, as i's are across two levels of the tree.



Only way this interpretation works is if you treat G2 as the same level with no internal transitions.