1) Data Association

- $K$ objects $u_1, \dots, u_K$
- $K$ observations $v_1, \dots, v_K$, $Val(v_i) = \{a_1, \dots, a_L\}$
- $K$ correspondence variables $C_1, \dots, C_K$, where $Val(C_i) = \{1, \dots, K\}$
- known appearance model for each object $u_K$, $P_K(v_i = a_l \mid C_i = K)$

a) Compute acceptance probability for each MH step

$$A(x'|x) = \min\left(1, \frac{P(x')\,Q(x|x')}{P(x)\,Q(x'|x)}\right)$$

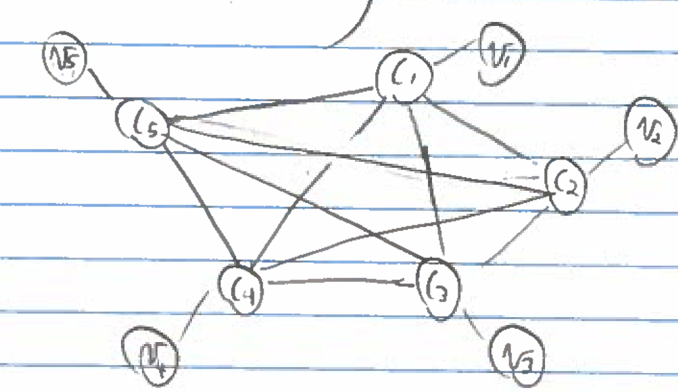
$$= \min\left(1, \frac{P(C'|v_1, \dots, v_K) \cdot Q(C|C')}{P(C|v_1, \dots, v_K) \cdot Q(C'|C)}\right)$$

$Q$ models the probability of sampling a new assignment $C' = \{C_1', C_2', \dots, C_K'\}$ given $C = \{C_1, C_2, \dots, C_K\}$
$Q(C'|C)$ is 0 if $C'$ is not $C$ w/ exactly two values swapped
$Q(C'|C)$ is uniform otherwise

Since $Q(C'|C)$ and $Q(C|C')$ are equally likely, these cancel to 1 in $A$.

$$A(C'|C) = \min\left(1, \frac{P(C'|v_1, \dots, v_K)}{P(C|v_1, \dots, v_K)}\right)$$

We can use the following MRF to describe the problem:




$C$s are fully connected, $v_i$s are only connected to corresponding $C_i$