Algorithm 1 The C-DP Algorithm

Input: The matrix of all User-Service M_{US}, the number of Interest K, hyper-parameter α and β

Output: the $n_k^{(s)}$, $n_k^{(u)}$, $n_{\cdot}^{(u)}$, $n_k^{(\cdot)}$ of the last time slice and the $n_k^{(s)}$, $n_k^{(u)}$, $n_{\cdot}^{(u)}$, $n_k^{(\cdot)}$ of the T_s time slice

1: **For** each time slices
2: **For** each user
3: **For** each preference
4: Preference ←random (1, *K*)
5: **End for**
6: **End for**
7: **End for**
8: **Use** formula (4) **for** Gibbs sampling.
9: Draw the User-Preference matrix θ
10: Draw the Preference -Service matrix Φ
11: **For** every element θ_{mk} in matrix θ
12: **For** every element Φ_{kn} in matrix Φ
13: Do $P_{mn} = \theta_{mk} \times \Phi_{kn}$
14: **End for**
15: **End for**
16: **For** each time slices
17: Calculate similarities between T_t and other time slices with formula (1) and (2)
18: **End for**
19: Find T_s time slice
20: **Return** the $n_k^{(s)}$, $n_k^{(u)}$, $n_{\cdot}^{(u)}$, $n_k^{(\cdot)}$ of the last time slice and the $n_k^{(s)}$, $n_k^{(u)}$, $n_{\cdot}^{(u)}$, $n_k^{(\cdot)}$ of the T_s time slice

Input: The matrix in t of User-Service M_{US}, the number of Interest K, hyper-parameter α and β, weight w_1, w_2, w_{s1}, w_{s2}, the $n_k^{(s)}$, $n_k^{(u)}$, $n_{\cdot}^{(u)}$, $n_k^{(\cdot)}$ of the last time slice, the $n_k^{(s)}$, $n_k^{(u)}$, $n_{\cdot}^{(u)}$, $n_k^{(\cdot)}$ of the T_s time slice

Output: The User- Service score matrix P_{ij}

1: **For** each user
2: **For** each preference
3: Preference ←random (1, *K*)
4: **End for**
5: **End for**
6: **Use** formula (6) and (7) **for** Gibbs sampling.
7: Draw the User-Preference matrix θ
8: Draw the Preference -Service matrix Φ
9: **For** every element θ_{mk} in matrix θ
10: **For** every element Φ_{kn} in matrix Φ
11: Do $P_{mn} = \theta_{mk} \times \Phi_{kn}$
12: **End for**
13: **End for**
14: **Return** User- Service score matrix P_{ij}