
Algorithm 1 PSEUDOCODE FOR $k=3$ ALGORITHMS

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1: for each neighbor  $n$  do
2:   Send variable assignment and reward matrices to  $n$ 
3:   Receive variable assignment and reward matrices from  $n$ 
4: Aggregate all information
5: for each neighbor  $n$  do
6:   Send all aggregated information to  $n$ 
7:   Receive aggregate information from  $n$ 
8: for each triple of 3 connected agents that includes me do
9:   Find maximum gain,  $g$ , the corresponding neighbors to act
   with,  $p, p'$ , and the variable assignment,  $a$ :
    $g, p, p', a \leftarrow \text{getMaxGainAndAssignmentForTriple}()$ 
10: Send Offer to form triple to  $p$  and  $p'$ 
11: Respond to any Offer messages received:
12: if agent requesting to form triplet  $\in \{p, p'\}$  then
13:   Send Accept to agent
14: else
15:   Send Reject to agent
16: Receive responses from neighbors, if any
17: if (reject[ $p$ ]) or (reject[ $p'$ ]) then
18:    $p \leftarrow \emptyset$ 
19:    $p' \leftarrow \emptyset$ 
20: Find best  $k=2$  action using algorithm described in paper:
    $g, p, a \leftarrow \text{getMaxGainAndAssignmentForPair}()$ 
21: Send Offer to  $p$ 
22: for all Offer messages received do
23:   if (agent requesting to pair is  $p$ ) then
24:     Send Accept to  $p$ 
25:   else
26:     Send Reject to  $p$ 
27:   if (reject[ $p$ ]) then
28:      $p \leftarrow \emptyset$ 
29:   Find max gain and preferred assignment ( $k=1$ ):
    $g, a \leftarrow \text{getMaxGainAndAssignment}()$ 
30: Send Bid ( $g$ ) to all neighbors
31: Receive Bids ( $\text{gainNeighbors}_n$ ) from all neighbors
32:  $G \leftarrow \max_n \text{gainNeighbors}_n$ 
33: if ( $g > G$ ) then
34:    $bChanging \leftarrow \text{True}$ 
35:   for all  $n \in p, p', \text{s.t. } n \neq \emptyset$  do
36:     Send ConfirmVariableChange to  $n$ 
37: else
38:    $bChanging \leftarrow \text{False}$ 
39:   for all  $n \in p, p', \text{s.t. } n \neq \emptyset$  do
40:     Send ProhibitVariableChange to  $p$ 
41: Receive any messages sent by neighbors
42: if (ProhibitVariableChange[ $p$ ] and  $p \neq \emptyset$ ) or
   (ProhibitVariableChange[ $p'$ ] and  $p' \neq \emptyset$ ) then
43:    $bChanging \leftarrow \text{False}$ 
44: if ( $bChanging$ ) then
45:   UpdateAssignment( $a$ )
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