SOLUTION TO PROBLEM Q1A

We can solve this problem using Integer Linear Programming (which I explored due to this assignment :) ) For this we may use Pulp library in Python. I tried my best to code this but due to lack of knowledge about python (I knew nothing about Python) I was unable to code(especially constraints) . Please see the following pseudo code.

First take input for m,n. Then we can use 2D list to store input of specifications of participants and projects. Then we can use LpProblem function for maximizing no. of projects.

Decision Variables :

Binary variable X (n,r,p) : which is 1 if participant n is assigned role r in project p else 0

Binary variable Y (m,n,p): which is 1 if participant n is mentoring participant m in project p else 0

Binary variable K(p): 1 if project p is complete else 0

Optimization Function :

Sum of K over all p

Constraints :

1. Each role in a project can be assigned to atmost 1 participant. Which means in 3D array X if we keep r,p constant then 1 will occur at most corresponding to 1 participant. So

For all combinations p,r sum(X over n)<=1

1. Each participant can work only on 1 role only in 1 project only

So for all n Sum(X over all r,p)<=1

1. If a participant has the required skill level for a role, they MAY be assigned to that role
2. If a participant n has skill level for particular role r in project p less than (required skill level -1) then participant CERTAINLY can’t be assigned that role . So X(n,r,p)==0
3. If a participant m has skill level==(req skill level-1) for a role, but another participant is mentoring them i.e. participant n has skill level>=(req skill level+1), they can be assigned to that role: So

for all p, r, n, m: X[p, r, m] <= X[p, r, n] \* (IS required skill level[p, r] <= skill level of n-1) \*Y[m,n,p]

1. Each participant can mentor at most one other participant in a project:

for all p, n: sum(Y[m,n,p] over all m) <= 1

1. A project is completed when all roles are filled:

If project p has required no. of participants filled then K[p]==1

Else K[p]==0

With above mentioned approach this problem can be solved. But I did not get time to learn Python language (though I learnt basics like loops, list, dictionary) , so I was unable to code constraints.

Please see other document containing my journey of solving this problem.