Quiz #9: Recommendation Systems

Name: GRADER ID: _____

1) (4pts) Using item-based CF (N=2) and the Pearson correlation, calculate the rating prediction of **item 3 for user 1** using average ratings based on all ratings

$$w_{i,j} = \frac{\sum_{u \in U}(r_{u,i} - \bar{r}_i)(r_{u,j} - \bar{r}_j)}{\sqrt{\sum_{u \in U}(r_{u,i} - \bar{r}_i)^2}\sqrt{\sum_{u \in U}(r_{u,j} - \bar{r}_j)^2}} \qquad P_{u,i} = \frac{\sum_{n \in N} r_{u,n} w_{i,n}}{\sum_{n \in N} |w_{i,n}|}$$

	I1	I2	I3	I4
U1	2	1		3
U2	3	?	5	2
U3		4	2	3
U4	5	3	1	
avg	10/3	8/3	8/3	8/3

[1 POINT]

[2 POINTS]

$\{U_2, U_4\} \rightarrow w_{1,3} = \frac{(3-10/3)(5-8/3)+(5-\frac{10}{3})(1-8/3)}{\sqrt{(3-10/3)^2+(5-10/3)^2}\times\sqrt{(5-8/3)^2+(1-8/3)^2}} \approx -0.73$

$\{U_3, U_4\} \rightarrow w_{2,3} = \frac{(4-8/3)\times(2-8/3)+(3-8/3)\times(1-8/3)}{\sqrt{(4-8/3)^2+(3-8/3)^2}\times\sqrt{(2-8/3)^2+(1-8/3)^2}} \approx -0.59$

$\{U_2, U_3\} \rightarrow w_{2,3} = \frac{(5-8/3)\times(2-8/3)+(2-8/3)\times(3-8/3)}{\sqrt{(5-8/3)^2+(2-8/3)^2}\times\sqrt{(2-8/3)^2+(3-8/3)^2}} \approx -0.98$

N = 2
choose top 2 Pearson correlations w_{13}, w_{23}

$P_{U_1,i3}$ = [1 POINT]

$= \frac{w_{13}\times r_{11} + w_{23}\times r_{12}}{|w_{13}|+|w_{23}|}$

$= \frac{-0.73\times 2 + (-0.59)\times 1}{|-0.73|+|-0.59|}$

≈ -1.55

2) (2pts) Briefly explain the difference between feature augmentation and meta-level hybrid using examples.

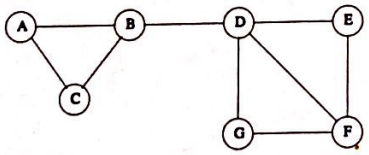
[1 POINT]

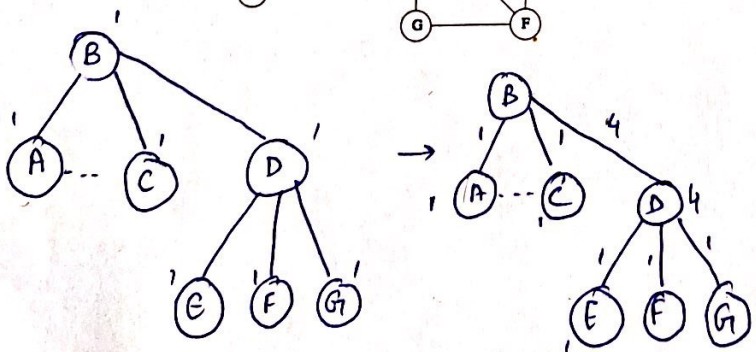
Feature augmentation - generates a new feature for each item by using the recommendation logic of the contributing domain. eg:- content-based model over the training data & then using that model to generate ratings for unrated items.

meta-level - model learned by one recommender as input for another. example- restaurant recommender that uses naive bayes techniques to build models of user prof in a content-based way.

[1 POINT]

3) (4 pts) For node B, use the Girvan-Newman algorithm to calculate the betweeness of each edge (do this for node B ONLY). You need to show the steps of your calculation.





[1 POINT] [1 POINT]

[2 POINTS]

1) Perform a BFS of the graph starting node B

2) Label each node by number of shortest paths for each from the root.

3) Each node other than the root gets credit of 1.

4) Each node that not the leaf gets credit = 1 + sum of credit of edges.

5) Credit is shared for node with more than 1 parent.