National University of Computer & Emerging Sciences, Karachi
Fall 2023
School of Computing
Midterm-II Examination
8th November 2023, 11:30 am – 12:30 pm

Course Code: CS4053 / AI4006	**Course Name:** Recommender Systems
Course Instructor: Syed Zain Ul Hassan	
Student ID:	**Section:**

Instructions:

- Return the question paper after exam.
- There are **4 questions** on **1 page** with **2 sides**.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 60 minutes **Max Marks**: 30 Points

Question 1 (CLO: 1, estimated time: *15 minutes*) **10 points**

Consider the given data:

	Item 1	Item 2	Item 3	Item 4
User 1	1	1	1	1
User 2	2	2	2	1
User 3	2	?	1	2

Find the posterior $P(r_{i2} = 1 \mid X)$ *(the probability of Item 2 being rated as 1)* using Naïve Bayes user-based Collaborative Filtering.
Note: The possible ratings in the system are 1 and 2. Assume $\alpha = 0.01$ and $\beta = 0.02$.

Question 2 (CLO: 1, estimated time: *10 minutes*) **5 points**

Consider the given table depicting the features of mobile phones available for purchase.

	Is New?	Price (in millions)	Area (sq yd)
Property 1	Yes	8.5	125
Property 2	No	8.1	125

Use case-based knowledge driven technique to recommend the most suitable property for the given user requirements.

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Feature	Is New?	Price (in millions)	Area (sq yd)
Requirement	Yes	7.0	120
Weight	1	2	1.5

Question 3 (CLO: 3, estimated time: *10 minutes*) (2.5 + 2.5) **5 points**

Consider the given 4x4 interaction matrix and its two factors:

5	3	5	3
	2		3
5	4	1	
3		2	

1	0
0	2
5	5
3	4.5

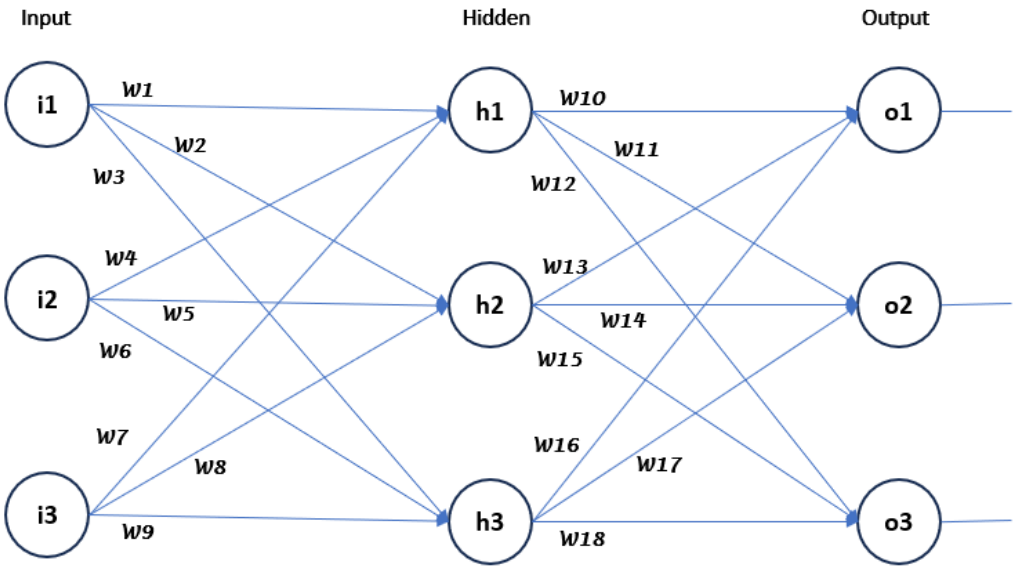
5	3	5	3
2	0.5	0.5	1

a) Do the given factors accurately represent the interactions provided in this matrix? Justify your answer.

b) Does Matrix Factorization suffer from cold-start user problem? Justify your answer.

Question 4 (CLO: 4, estimated time: *20 minutes*) **10 points**

Consider the neural network given below:



Item features:	0.5	0.8	0.7

Initial weights are **w1** = **w2** = **w10** = **w11** = 0.5; **w3** = **w4** = **w12** = **w13** = 0.6; **w5** = **w6** = **w14** = **w15** = 0.7; **w7** = **w8** = **w16** = **w17** = 0.8; and **w9** = **w18** = 0.9. We can also assume that the sum of output values produced by this linear network need not be 1 and the possible ratings (class labels) are **1** (:*o1*), **2** (:*o2*) and **3** (:*o3*).

Run a single forward-pass and determine the rating (label) produced by this model.

Good luck!