Question 1:

a) The degree of personalization has a direct impact on the serendipity in recommender systems. The more serendipity an algorithm offers, the less we can expect to have personalized recommendations.
Yes. We can control serendipity in user-based collaborative filtering with the help of hyperparameter k.

b) With mean-centered predictions, we can grasp the rating pattern of a user and not just their raw rating values.

c) We can use content-based filtering for this since only the behavior of our current user is to be used. What other users may like or dislike will be subject to their connections.

d) It cannot solve cold-start user problem since a new user will not have any historical data.

e) Since the no. of users are much less than no. of rated items, the ideal technique in this scenario, both in terms of computational requirements and performance, would be user-based collaborative filtering.

Question 2:

Feature matrix =

			Comfort	Daily use	Health	Travel
Chair	2		1	1	0	0
Cycle	5		0	1	1	1

User profile =

Comfort	Daily use	Health	Travel
0.105	0.368	0.263	0.263

Item profiles =

	Comfort	Daily use	Health	Travel
Bottle	0	1	1	0
Gloves	1	0	1	0

Comfort	Daily use	Health	Travel
0.105	0.368	0.263	0.263

x

	Comfort	Daily use	Health	Travel
Bottle	0	1	1	0
Gloves	1	0	1	0

	Comfort	Daily use	Health	Travel
Bottle	0	0.368	0.263	0
Gloves	0.105	0	0.263	0

Bottle	**0.631**
Gloves	0.368

Bottle will be recommended to the user.

Question 3:

a) r(U3, U1) = 0.77
    r(U3, U2) = 0.62
    r(U3, U4) =-0.45

b) *Prediction*:   R(U3, I2) = 3.66 + [(0.77 x -0.66) + (0.62 x -1)] / (0.77 + 0.62)
                  R(U3, I2) = 2.84 ≈ **3.**

… EOF …