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Homework 2
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1) Matrix Calculations
    a) j(user 1, user 2) = |{0,1,4}|/|{0,1,2,3,4,5}| = 3/6 = 0.5
    j(user 1, user 3) = |{0,1,4}|/|{0,1,2,3,4,5}| = 3/6 = 0.5
    j(user 2, user 3) = |{0,1,2,3,4}|/|{0,1,2,3,4}| = 5/5 = 1
    b) sim(user 1, user2) = {4,5,0,5,1,0} . {0,3,4,3,1,2} / $\sqrt{(4^2 + 5^2 + 0 + 5^2 + 1 + 0)} * \sqrt{(0 + 3^2 + 4^2 + 3^2 + 1 + 2^2)}$
    = 31 / 51.1175 = 0.6064
    sim(user 1, user 3) = 23 / 44.8330 = 0.5130
    sim(user 2, user3) = 21 / 34.2052 = 0.6139
    c)

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6
User 1	1.5	2.5		2.5	-1.5	
User 2		0.833	1.833	0.833	-1.166	-0.166
User 3	0.333		-0.666	1.333		2.333

    d) sim(user 1, user 2) = 5.914 / 10.166 = 0.5817
    sim(user 1, user 3) = 3.832 / 10.8203 = 0.3541
    sim(user 2, user 3) = -0.4976 / 6.9060 = -0.072

2) Summaries
    a) Two Decades of Recommender Systems at Amazon.com

Since the 1990s Amazon has changed the game for recommendations. THe standard at the time was a User-User approach which compared two users and suggested their purchases. This had many inherent issues such as someone who buys a lot of things via Amazon vs someone who doesn't. What Amazon discovered is that it is more likely that two items are related than two people so they pioneered Item-Item recommendation. From just selling books to the millions of items in Amazon's catalog this has proven to be a more accurate way to recommend items to users.

Item-Item has proven to be more accurate and more adaptable over time to the changing landscape of online retail that Amazon has been on top of since then. This does not mean that Item-Item is not without flaw. The issue of time is one that Amazon is continuing to work on. Time in relation to what order items were purchased to suggest one leads to the other. Time as one's needs change over the course of their life or the life of someone they're providing for.

Amazon's switch to Item-Item was a game changer in the world of recommendation systems, but is not the end. Advances are made every day and new algorithms may put Item-Item in the past.

b) Amazon Recommendations

In this earlier paper, the change from User-User to Item-Item is covered more. It covers cluster models and search based models. It also covers the scalability in less detail since there was less information available at the time.