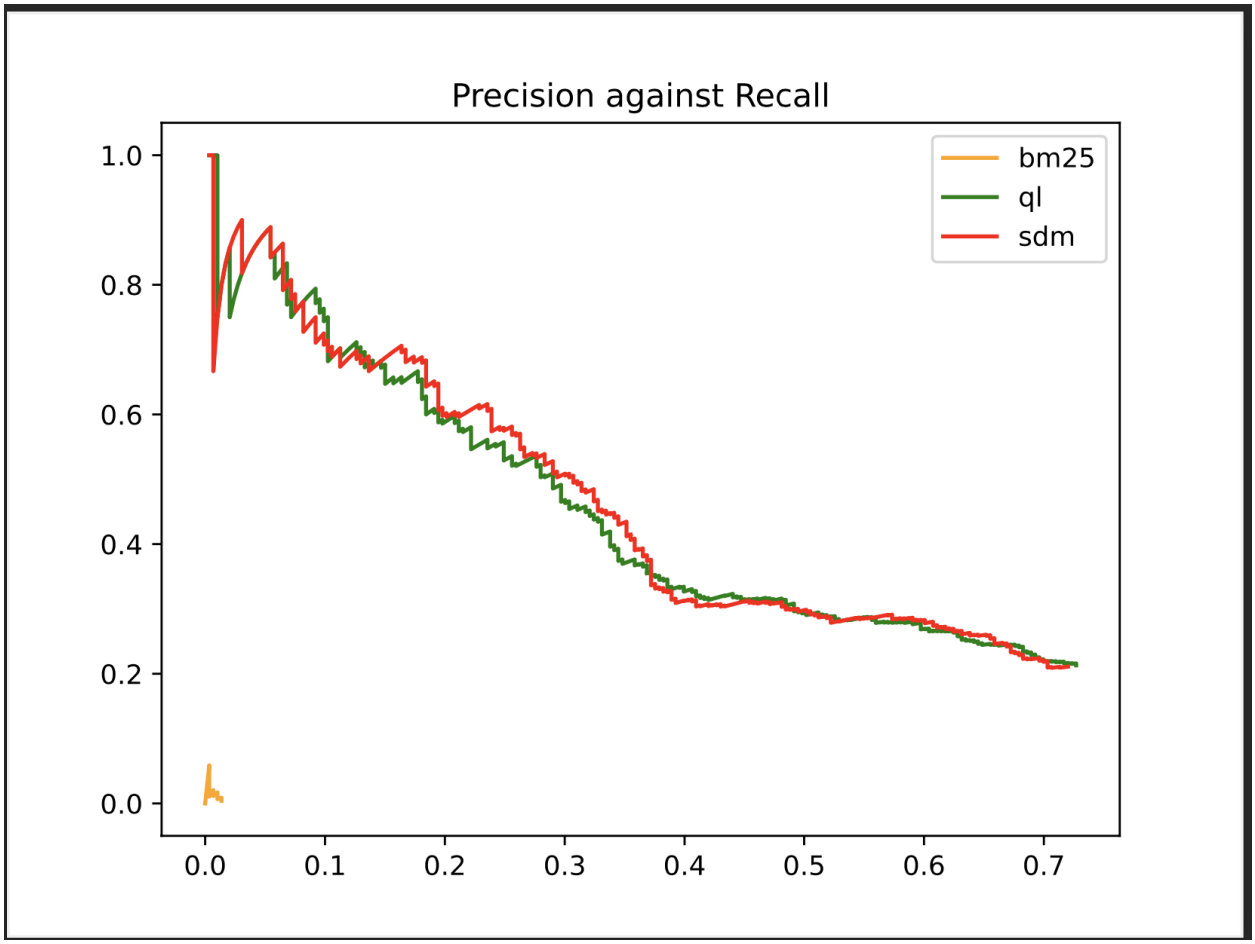
1. I indicated in the code where the evaluation exists.
2. I designed my precision and recall similar to the pseudo-code form quiz 5. At first my MAP function was making my code run for more than five minutes, however, I reworked it to decrease the run time of the program by a little amount. I got rid of a couple loops in order to do so.
3. I imported matplotlib and log from math. I imported matplotlib in order to plot the precision/ recall graph for query 450. Then I imported log from math in order to do my NDCG function.
4.

bm25.trecrun	NDCG@100	0.14487446862097264
bm25.trecrun	MRR	0.22380945023867177
bm25.trecrun	P@10	0.1392904953145917
bm25.trecrun	Recall@15	0.05768634584918899
bm25.trecrun	F1@20	0.07470025247608356
bm25.trecrun	MAP	0.13046833007441191
ql.trecrun	NDCG@100	0.4128718289531195
ql.trecrun	MRR	0.700439431815912
ql.trecrun	P@10	0.4274431057563588
ql.trecrun	Recall@15	0.18047043108948013
ql.trecrun	F1@20	0.2196392410874987
ql.trecrun	MAP	0.3280246365816244
sdm.trecrun	NDCG@100	0.4181756131480778
sdm.trecrun	MRR	0.6729665240507848
sdm.trecrun	P@10	0.4338688085676033

sdm.trecrun	Recall@15	0.18176426571982895
sdm.trecrun	F1@20	0.2224799425007887
sdm.trecrun	MAP	0.3356597407085085
stress.trecrun	NDCG@100	0.14717756289454242
stress.trecrun	MRR	0.5648744520953338
stress.trecrun	P@10	0.22226720647773307
stress.trecrun	Recall@15	0.06416251875844971
stress.trecrun	F1@20	0.08144812430160349
stress.trecrun	MAP	0.36343024569359617

5. Given what I know of the retrieval models involved, we might be seeing these results because of how each of the retrieval models work. For example, precision and recall need to be between 0 and 1, which the table does indicate this. Essentially these mean scores should all be between 0 and 1.
6. This is a hard question because you eventually end up trying to divide by zero which technically isn't possible to do so. I believe the answer should be 0 because there are no retrieved documents to begin with so that means that recall never increases and precision is never accumulated.

7. 
Precision against Recall
bm25
ql
sdm
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7