Indian Institute of Technology Jodhpur

CSL7110 Machine Learning with Big Data

Assignment 1: Map-Reduce and Similar Itemsets Mining

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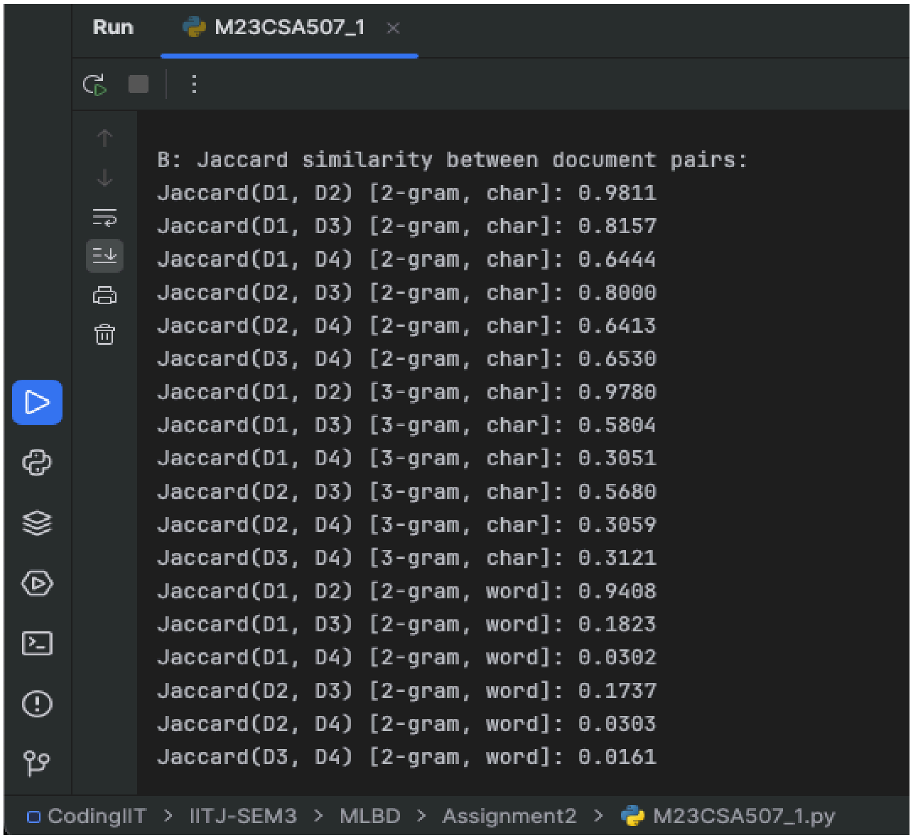
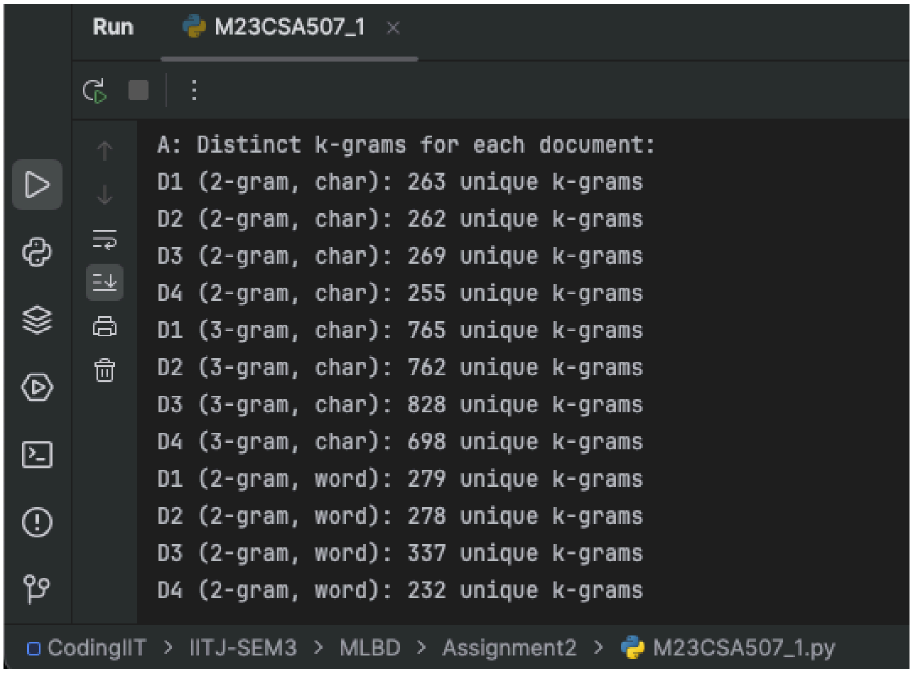
1. Create k-Grams

A.



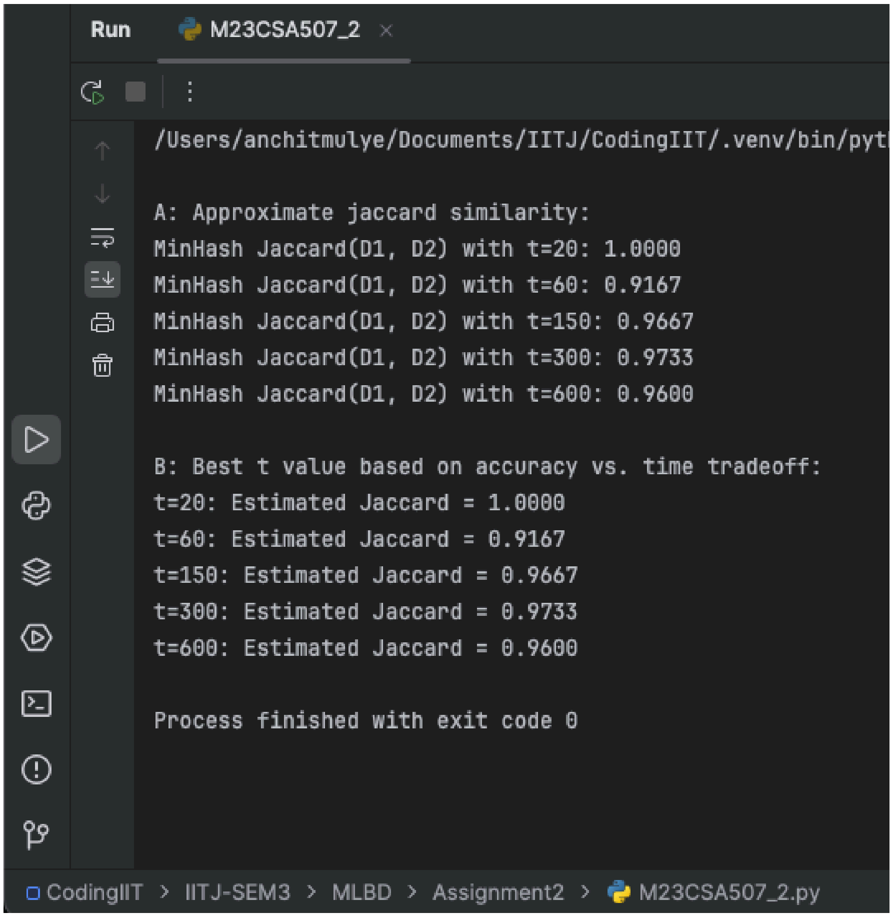
```
B: Jaccard similarity between document pairs:
Jaccard(D1, D2) [2-gram, char]: 0.9811
Jaccard(D1, D3) [2-gram, char]: 0.8157
Jaccard(D1, D4) [2-gram, char]: 0.6444
Jaccard(D2, D3) [2-gram, char]: 0.8000
Jaccard(D2, D4) [2-gram, char]: 0.6413
Jaccard(D3, D4) [2-gram, char]: 0.6530
Jaccard(D1, D2) [3-gram, char]: 0.9780
Jaccard(D1, D3) [3-gram, char]: 0.5804
Jaccard(D1, D4) [3-gram, char]: 0.3051
Jaccard(D2, D3) [3-gram, char]: 0.5680
Jaccard(D2, D4) [3-gram, char]: 0.3059
Jaccard(D3, D4) [3-gram, char]: 0.3121
Jaccard(D1, D2) [2-gram, word]: 0.9408
Jaccard(D1, D3) [2-gram, word]: 0.1823
Jaccard(D1, D4) [2-gram, word]: 0.0302
Jaccard(D2, D3) [2-gram, word]: 0.1737
Jaccard(D2, D4) [2-gram, word]: 0.0303
Jaccard(D3, D4) [2-gram, word]: 0.0161
```

B.



```
A: Distinct k-grams for each document:
D1 (2-gram, char): 263 unique k-grams
D2 (2-gram, char): 262 unique k-grams
D3 (2-gram, char): 269 unique k-grams
D4 (2-gram, char): 255 unique k-grams
D1 (3-gram, char): 765 unique k-grams
D2 (3-gram, char): 762 unique k-grams
D3 (3-gram, char): 828 unique k-grams
D4 (3-gram, char): 698 unique k-grams
D1 (2-gram, word): 279 unique k-grams
D2 (2-gram, word): 278 unique k-grams
D3 (2-gram, word): 337 unique k-grams
D4 (2-gram, word): 232 unique k-grams
```

2. Min-Hashing



```
/Users/anchitmulye/Documents/IITJ/CodingIIT/.venv/bin/pyt

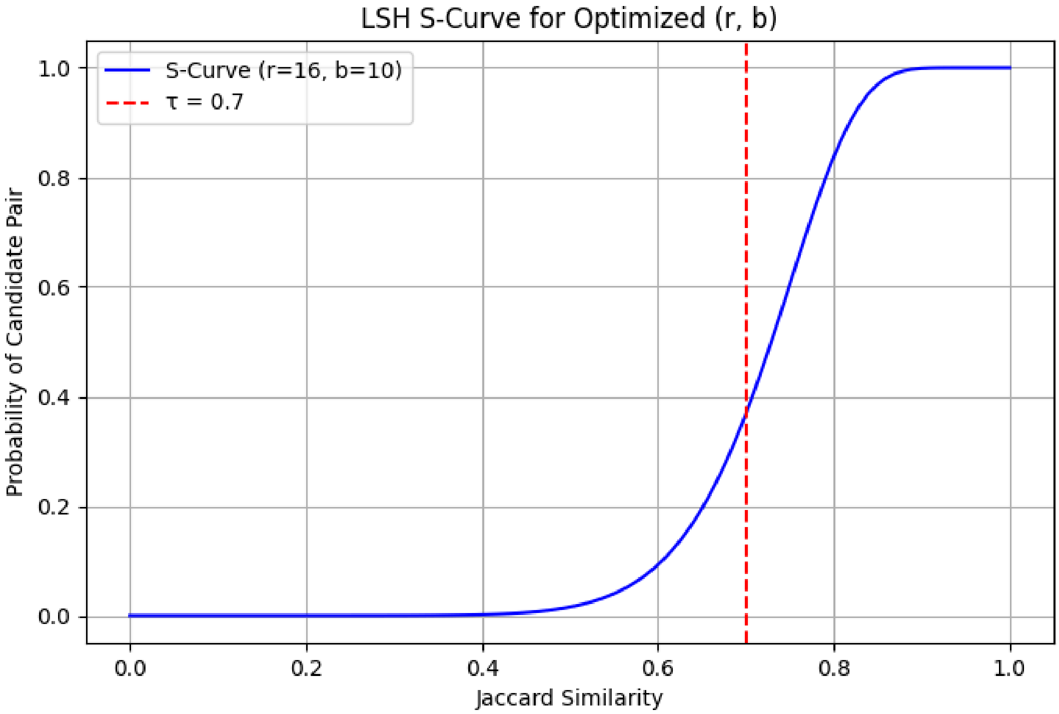
A: Approximate jaccard similarity:
MinHash Jaccard(D1, D2) with t=20: 1.0000
MinHash Jaccard(D1, D2) with t=60: 0.9167
MinHash Jaccard(D1, D2) with t=150: 0.9667
MinHash Jaccard(D1, D2) with t=300: 0.9733
MinHash Jaccard(D1, D2) with t=600: 0.9600

B: Best t value based on accuracy vs. time tradeoff:
t=20: Estimated Jaccard = 1.0000
t=60: Estimated Jaccard = 0.9167
t=150: Estimated Jaccard = 0.9667
t=300: Estimated Jaccard = 0.9733
t=600: Estimated Jaccard = 0.9600

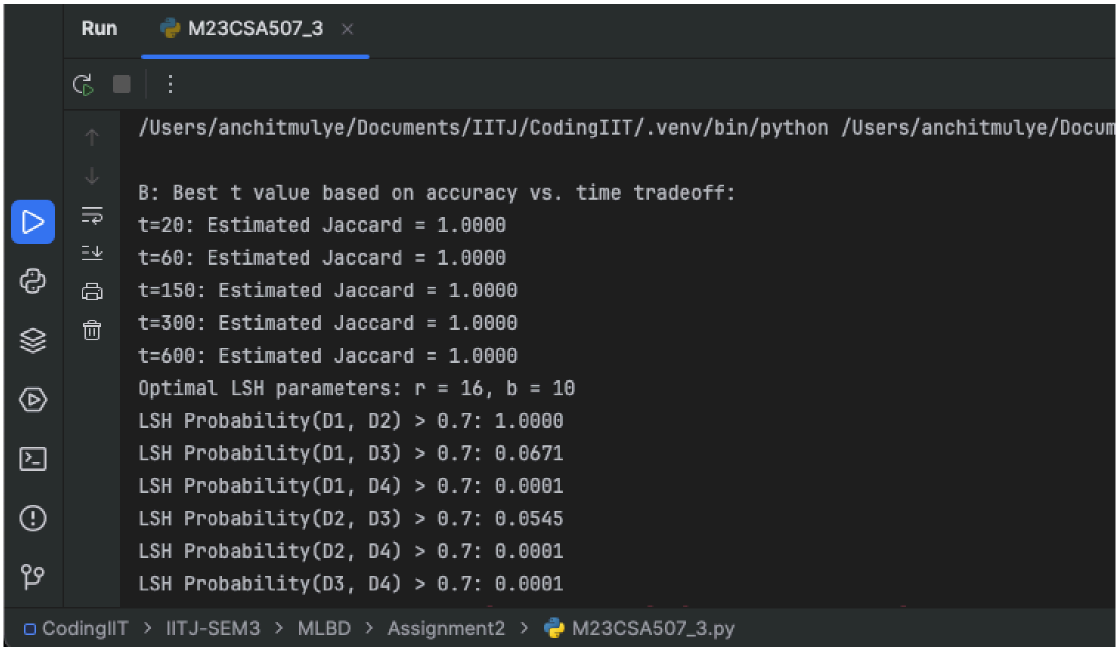
Process finished with exit code 0
```

3. LSH:

A.



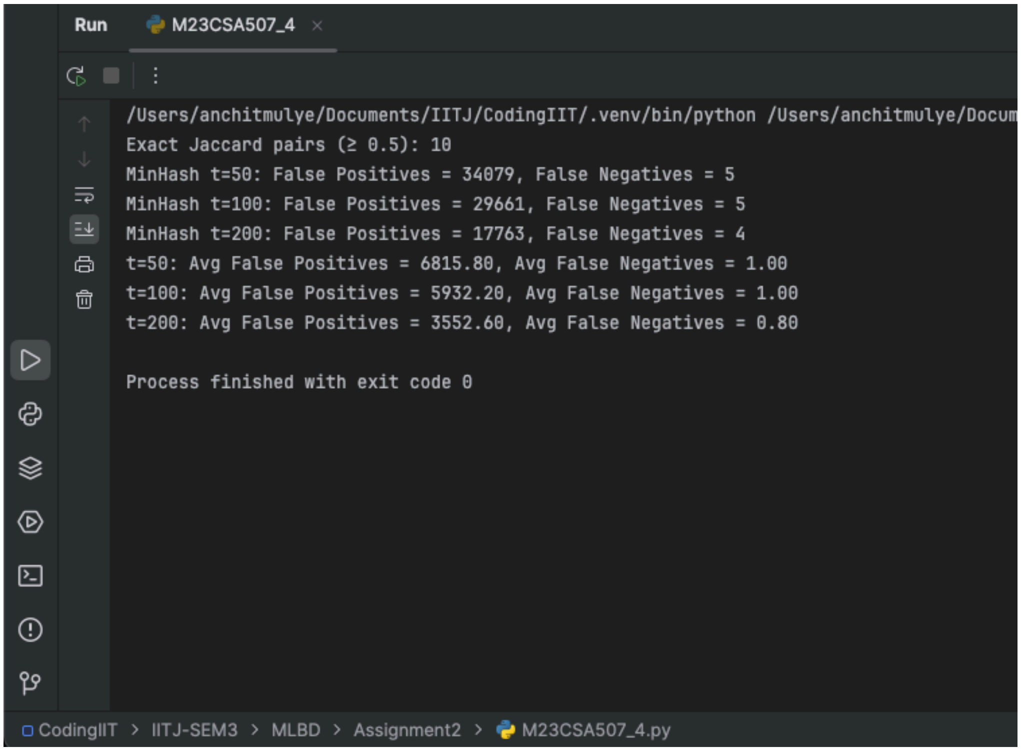
B.



```
/Users/anchitmulye/Documents/IITJ/CodingIIT/.venv/bin/python /Users/anchitmulye/Docum

B: Best t value based on accuracy vs. time tradeoff:
t=20: Estimated Jaccard = 1.0000
t=60: Estimated Jaccard = 1.0000
t=150: Estimated Jaccard = 1.0000
t=300: Estimated Jaccard = 1.0000
t=600: Estimated Jaccard = 1.0000
Optimal LSH parameters: r = 16, b = 10
LSH Probability(D1, D2) > 0.7: 1.0000
LSH Probability(D1, D3) > 0.7: 0.0671
LSH Probability(D1, D4) > 0.7: 0.0001
LSH Probability(D2, D3) > 0.7: 0.0545
LSH Probability(D2, D4) > 0.7: 0.0001
LSH Probability(D3, D4) > 0.7: 0.0001
```

4. Min-Hashing on MovieLens dataset



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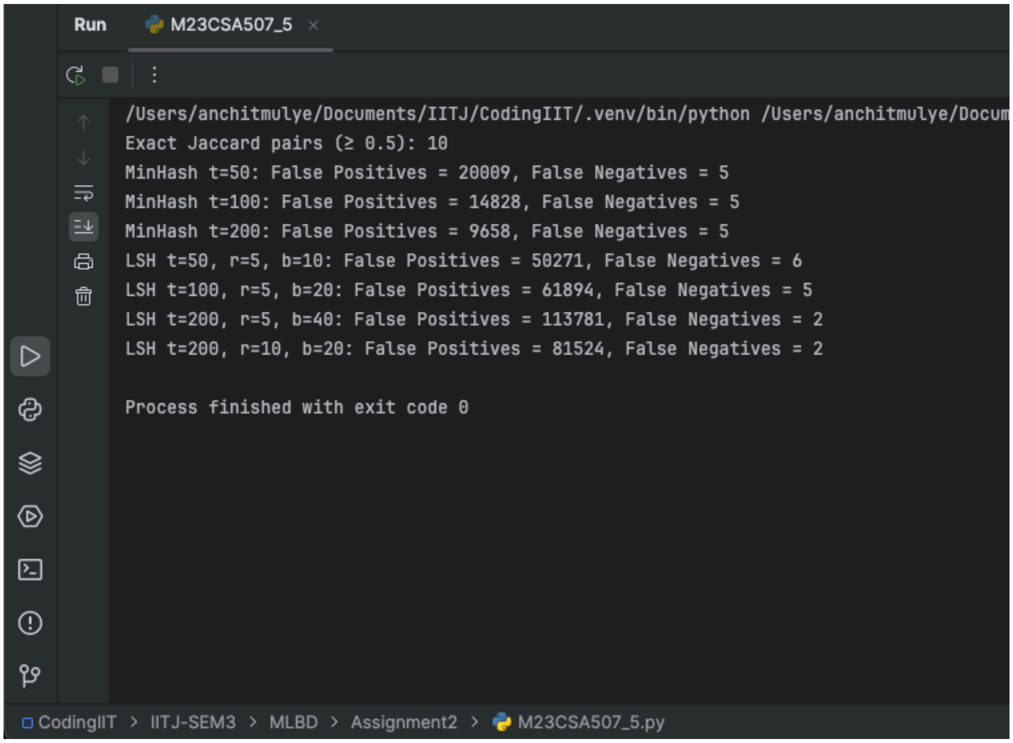
/Users/anchitmulye/Documents/IITJ/CodingIIT/.venv/bin/python /Users/anchitmulye/Docum
Exact Jaccard pairs (≥ 0.5): 10
MinHash t=50: False Positives = 34079, False Negatives = 5
MinHash t=100: False Positives = 29661, False Negatives = 5
MinHash t=200: False Positives = 17763, False Negatives = 4
t=50: Avg False Positives = 6815.80, Avg False Negatives = 1.00
t=100: Avg False Positives = 5932.20, Avg False Negatives = 1.00
t=200: Avg False Positives = 3552.60, Avg False Negatives = 0.80

Process finished with exit code 0
```

5. LSH on MovieLens dataset



```
/Users/anchitmulye/Documents/IITJ/CodingIIT/.venv/bin/python /Users/anchitmulye/Docum
Exact Jaccard pairs (≥ 0.5): 10
MinHash t=50: False Positives = 20009, False Negatives = 5
MinHash t=100: False Positives = 14828, False Negatives = 5
MinHash t=200: False Positives = 9658, False Negatives = 5
LSH t=50, r=5, b=10: False Positives = 50271, False Negatives = 6
LSH t=100, r=5, b=20: False Positives = 61894, False Negatives = 5
LSH t=200, r=5, b=40: False Positives = 113781, False Negatives = 2
LSH t=200, r=10, b=20: False Positives = 81524, False Negatives = 2

Process finished with exit code 0
```