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Assignment 3

(A) Pivot table: CC + Loan vs Online

	CC	Loan	0	1
1	0	0	785	1145
2	0	1	65	122
3	1	0	317	475
4	1	1	34	57

(B) Empirical $P(\text{Loan}=1 \mid \text{CC}=1, \text{Online}=1) = 0.1071429$

(C1) Pivot table: Loan vs Online

	Loan	0	1
1	0	1102	1620
2	1	99	179

(C2) Pivot table: Loan vs CC

	Loan	0	1
1	0	1930	792
2	1	187	91

(D) Conditional probabilities:

$$P(\text{CC}=1 \mid \text{Loan}=1) = 0.3273381$$

$$P(\text{Online}=1 \mid \text{Loan}=1) = 0.6438849$$

$$P(\text{Loan}=1) = 0.09266667$$

$$P(\text{CC}=1 \mid \text{Loan}=0) = 0.2909625$$

$$P(\text{Online}=1 \mid \text{Loan}=0) = 0.5951506$$

$$P(\text{Loan}=0) = 0.9073333$$

$$(E) \text{ Manual Naive Bayes } P(\text{Loan}=1 \mid \text{CC}=1, \text{Online}=1) = 0.1105637$$

(F) Comparison:

$$\text{Empirical} = 0.1071429 ; \text{Manual Naive Bayes} = 0.1105637$$

The estimates are very close. The Naive Bayes estimate is slightly higher because it uses conditional probabilities to adjust for the other factors.

$$(G) \text{ Model-based Naive Bayes } P(\text{Loan}=1 \mid \text{CC}=1, \text{Online}=1) = 0.1105637$$

It gives the same probability.