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B365 Midterm

Question 1

a) The variables are not independent because the gaps between the boxes do not line up
b) P(Survive | Female) ~= 0.75
c) P(Survive) ~= 0.3
d) Females had significantly higher rates of survival than men (0.75 vs. 0.2) and the variables are not independent.
It can be concluded that women were more likely to survive than men, despite having approximately equal number of survivors between the genders.
e) Gender would be a useful variable because the effects of gender are evident when comparing the rates of survival between men and women.

Question 2

P(bumped | not A) = (P(bumped | B) * P(B) + P(bumped | C) * P(C)) / (P(B) + P(C))
= (0.001 * 0.6 + 0.01 * 0.3) / (0.6 + 0.3) = 0.004

P(bumped | not B) = (P(bumped | A) * P(A) + P(bumped | C) * P(C)) / (P(A) + P(C))
= (0.0001 * 0.1 + 0.01 * 0.3) / (0.1 + 0.3) = 0.007525

P(bumped | not C) = (P(bumped | A) * P(A) + P(bumped | B) * P(B)) / (P(A) + P(B))
= (0.0001 * 0.1 + 0.001 * 0.6) / (0.1 + 0.6) = 0.000871428571

a) P(A | bumped) = P(A) * P(bumped | A) / (P(A) * P(bumped | A) + P(not A) * P(bumped | not A))
= 0.1 * 0.0001 / (0.1 * 0.0001 + 0.9 * 0.004) = 0.00277

b) P(B | bumped) = P(B) * P(bumped | B) / (P(B) * P(bumped | B) + P(not B) * P(bumped | not B))
= 0.6 * 0.001 / (0.6 * 0.001 + 0.4 * 0.007525) = 0.1662

c) P(C | bumped) = P(C) * P(bumped | C) / (P(C) * P(bumped | C) + P(not C) * P(bumped | not C))
= 0.3 * 0.01 / (0.3 * 0.01 + 0.7 * 0.000871428571) = 0.831

Question 3

a) x = x/1000
b) apply(x, 1, sum)
c) apply(x, 2, sum)
d) x[, 2] / sum(x[, 2])
e) apply(x, 1, sum) %*% t(apply(x, 2, sum))

Question 4

a) P(Survive) ~= 0.3, P(Not Survive) ~= 0.7
b) P(Male | Survive) ~= 0.5, P(Female | Survive) ~= 0.5
c) The Naive Bayes classifier would classify this passenger as a Survival.

The probability of survival for a Female is approximately 70%

The probability of survival for a Child is approximately 50%

The probability of survival for 2nd Class is approximately 40%

Naive Bayes assumes conditional independence, thus P(Female, child, 2nd class | Survive) = 0.7 * 0.5 * 0.4 = 0.14

Question 5

a)

```
p = runif(6)

for (i in 1:6) {
  p[i] = runif(1)

  while (sum(p) >= 1) {

          p[i] = runif(1)

  }

  if (i == 6) {
          p[i] = 1 - sum(p[0:5])
  }

}
```

b)

```
outcome = runif(1000)

for (i in 1:1000) {
          outcome[i] = 7-length(p[cumsum(p) > runif(1, 0, 1)])
}
```

c)

```
counts = rep(0, 6)
```

```
for (i in 1:1000) {
            counts[outcome[i]] = counts[outcome[i]] + 1
}

show(counts)
```