Herzlichen Glückwunsch! Sie haben bestanden!

ZUM BESTEHEN 75 % oder höher

Lernen Sie weiter

BEWERTUNG 100 %

Practice quiz on Bayes Theorem and the Binomial Theorem

GESAMTPUNKTZAHL 9

1. A jewelry store that serves just one customer at a time is concerned about the safety of its isolated customers

1 / 1 Punkten

- 10% of the times that a jewelry store is robbed, a customer is in the store.
- A jewelry store has a customer on average 20% of each 24-hour day.
- The probability that a jewelry store is being robbed (anywhere in the world) is 1 in 2 million.

What is the probability that a robbery will occur while a customer is in the store?

- ○ \begin {align}\frac{1}{500000}\end {align}
- ○ \begin {align}\frac{1}{2000000}\end {align}
- ◉ \begin{align}\frac{1}{4000000}\end{align}
- ○ \begin {align}\frac{1}{5000000}\end {align}

✓ **Richtig**

What is known is:

B: "a robbery is occurring," $P(B) = \frac{1}{2{,}000{,}000}$

$P(\text{a customer is in the store} \mid \text{a robbery occurs}) = P(A \mid B)$

$P(A \mid B) = 10\%$

What is wanted:

$P(\text{a robbery occurs} \mid \text{a customer is in the store}) = P(B \mid A)$

By the product rule:

\begin{align}P(B \mid A) = \frac{P(A,B)}{P(A)}\end{align}

and $P(A, B) = P(A \mid B)P(B)$

\begin{align}P(B \mid A)= \frac{P(A \mid B)P(B)}{P(A)}=\frac{(0.1)\left(\frac {1}{2000000}\right)}{0.2}=\frac{1}{4000000}\end{align}

2. If I flip a fair coin, with heads and tails, ten times in a row, what is the probability that I will get exactly six heads?

1 / 1 Punkten

- ○ 0.021
- ○ 0.187
- ◉ 0.2051
- ○ 0.305

✓ **Richtig**

By Binomial Theorem, equals

\begin{align}&=\left(\frac {10!}{4! \times 6!}\right) \left(\frac {1}{1024}\right)\\&=0.2051\end{align}

3. If a coin is bent so that it has a 40% probability of coming up heads, what is the probability of getting *exactly* 6 heads in 10 throws?

1 / 1 Punkten

- ○ 0.0974
- ○ 0.1045
- ◉ 0.1115
- ○ 0.1219

✓ **Richtig**

$\binom{10}{6} \times 0.4^6 \times 0.6^4 = 0.1115$

4. A bent coin has 40% probability of coming up heads on each independent toss. If I toss the coin ten times, what is the probability that I get at least 8 heads?

1 / 1 Punkten

- ○ 0.0312
- ○ 0.0132
- ○ 0.0213
- ◉ 0.0123

✓ **Richtig**

The answer is the sum of three binomial probabilities:

$((\binom{10}{8}) \times (0.4^8) \times (.6^2)) + ((\binom{10}{9}) \times (0.4^9) \times (0.6^1)) +$

$((\binom{10}{10}) \times (0.4^{10}) \times (0.6^0))$

5. Suppose I have a bent coin with a 60% probability of coming up heads. I throw the coin ten times and it comes up heads 8 times.

1 / 1 Punkten

What is the value of the "likelihood" term in Bayes' Theorem -- the conditional probability of the data given the parameter.

- ◉ 0.120932
- ○ 0.122885
- ○ 0.043945
- ○ 0.168835

✓ **Richtig**

Bayesian "likelihood" --- the p(observed data | parameter) is

p(8 of 10 heads | coin has p = .6 of coming up heads)

6. We have the following information about a new medical test for diagnosing cancer.

1 / 1 Punkten

Before any data are observed, we know that 5% of the population to be tested actually have Cancer.

Of those tested who do have cancer, 90% of them get an accurate test result of "Positive" for cancer. The other 10% get a false test result of "Negative" for Cancer.

Of the people who do not have cancer, 90% of them get an accurate test result of "Negative" for cancer. The other 10% get a false test result of "Positive" for cancer.

What is the conditional probability that I have Cancer, if I get a "Positive" test result for Cancer?

**Formulas in the feedback section are very long, and do not fit within the standard viewing window. Therefore, the font is a bit smaller and the word "positive test" has been abbreviated as PT.

- ○ 4.5%
- ◉ 32.1% probability that I have cancer

✓ **Richtig**

I still have a more than $\frac{2}{3}$ probability of not having cancer

Posterior probability:

p(I actually have cancer | receive a "positive" Test)

By Bayes Theorem:

$= \frac{\text{(chance of observing a PT if I have cancer)(prior probability of having cancer)}}{\text{(marginal likelihood of the observation of a PT)}}$

= (90%)(5%) / ((90%)(5%) + (10%)(95%)

=32.1%

7. We have the following information about a new medical test for diagnosing cancer.

1 / 1 Punkten

Before any data are observed, we know that 8% of the population to be tested actually have Cancer.

Of those tested who do have cancer, 90% of them get an accurate test result of "Positive" for cancer.

The other 10% get a false test result of "Negative" for Cancer.

Of the people who do not have cancer, 95% of them get an accurate test result of "Negative" for cancer.

What is the conditional probability that I have cancer, if I get a "Negative" test result for Cancer?

- ◉ 0.9%
- ○ $.80\%$
- ○ 88.2%
- ○ 99.1%

✓ **Richtig**

$p(\text{cancer} \mid \text{negative test}) =$

$\frac{p(\text{negative test} \mid \text{Cancer})\, p(\text{Cancer})}{p(\text{negative test} \mid \text{cancer})\, p(\text{cancer}) + p(\text{negative test} \mid \text{no cancer})\, p(\text{no cancer})}$

$\frac{(10\%)(8\%)}{(10\%)(8\%)+(95\%)(92\%)}$

$\frac{0.8\%}{88.2\%}$

$= 0.9\%$

8. An urn contains 50 marbles – 40 blue and 10 white. After 50 draws, exactly 40 blue and 10 white are observed.

1 / 1 Punkten

You are not told whether the draw was done "with replacement" or "without replacement."

What is the probability that the draw was done with replacement?

- ◉ 12.27%

- ○ 13.98%

✓ **Richtig**

p(40 blue and 10 white | draws without replacement) = 1 [this is the only possible outcome when 50 draws are made without replacement]

p(40 blue and 10 white | draws with replacement)

S = 40

N = 50

P = .8 [for draws with replacement] because 40 blue of 50 total means p(blue) = 40/50 = .8

$((\binom{50}{40}))(0.8^{40})(0.2^{10})$

By Bayes' Theorem:

p(draws with replacement | observed data) =

$\frac{13.98\%(.5)}{(13.98\%)(.5)+(1)(.5)}$

$= \frac{0.1398}{1.1398}$

$= 12.27\%$

The majority of all Smugglers at the border (65%) appear nervous and sweaty.

Only 8% of innocent people at the border appear nervous and sweaty.

If someone at the border appears nervous and sweaty, what is the probability that they are a Smuggler?

- ◉ 7.58%
- ○ 8.57%
- ○ 92.42%
- ○ 7.92%

✓ **Richtig**

By Bayes' Theorem, the answer is

\begin {align} \frac {(.65)(.01)}{ ((.65)(.01) + (.08)(.99))}\end {align}