1. **Set Up the Blank Cross‑Tab**

We have two categorical variables:

1. **Education**: College (**C**) vs. No College (¬C\lnot C)
2. **Vote Choice**: Republican (**R**), Democrat (**D**), or Did Not Vote (**NV**)

Since there are 1,000 total respondents, our table has 2 rows (for **C** vs. ¬C\lnot C) and 3 columns (for **R**, **D**, **NV**), plus row/column totals:

|  | **Republican (R)** | **Democrat (D)** | **Did Not Vote (NV)** | **Row Total** |
| --- | --- | --- | --- | --- |
| **College (C)** | ? | ? | ? | 400 |
| **No College (¬C\lnot C)** | ? | ? | ? | 600 |
| **Column Totals** | ? | ? | ? | 1000 |

* We already filled in the **row totals**:
  + #(C)=400\#(C) = 400 (given)
  + #(¬C)=600\#(\lnot C) = 600 (since 1000−400=6001000 - 400 = 600)
* We will fill in the **column totals** and individual cells step by step.

**2. Fill in What We Directly Know**

The problem statements give these numbers:

1. **400** respondents hold a college degree (that’s our row total for CC).
2. **400** respondents voted **Republican** and **do not** hold a college degree.
   * This is #(R∩¬C)=400\#(R \cap \lnot C) = 400.
3. **100** respondents voted **Republican** and **do** hold a college degree.
   * This is #(R∩C)=100\#(R \cap C) = 100.

Let’s fill those cells first:

|  | **Republican (R)** | **Democrat (D)** | **Did Not Vote (NV)** | **Row Total** |
| --- | --- | --- | --- | --- |
| **College (C)** | 100 | ? | ? | 400 |
| **No College (¬C\lnot C)** | 400 | ? | ? | 600 |
| **Column Totals** | ? | ? | ? | 1000 |

**2a. Determine the Total Who Voted Republican**

From those two cells:

#(R∩C)+#(R∩¬C)  =  100+400  =  500.\#(R \cap C) + \#(R \cap \lnot C) \;=\; 100 + 400 \;=\; 500.

Hence the **Republican** column total is 500500.

Update:

|  | **Republican (R)** | **Democrat (D)** | **Did Not Vote (NV)** | **Row Total** |
| --- | --- | --- | --- | --- |
| **College (C)** | 100 | ? | ? | 400 |
| **No College (¬C\lnot C)** | 400 | ? | ? | 600 |
| **Column Totals** | 500 | ? | ? | 1000 |

**3. Fill in the “Did Not Vote” Total and Democrat Total**

We also know:

1. **50** respondents **did not vote** in the last election.
   * So #(NV)\#(NV) = 50 in the “Did Not Vote” column total.
2. If there are 1,000 total respondents, and 500 of them voted Republican and 50 did not vote, the remainder (i.e., 1000−500−501000 - 500 - 50) must have voted Democrat:

#(D)=1000−500−50=450.\#(D) = 1000 - 500 - 50 = 450.

So let’s fill in those **column totals**:

|  | **Republican (R)** | **Democrat (D)** | **Did Not Vote (NV)** | **Row Total** |
| --- | --- | --- | --- | --- |
| **College (C)** | 100 | ? | ? | 400 |
| **No College (¬C\lnot C)** | 400 | ? | ? | 600 |
| **Column Totals** | 500 | 450 | 50 | 1000 |

**4. Fill in the Remaining Cells: “Did Not Vote” by Education**

We are given:

1. **40** respondents both **did not vote** and **did not** hold a college degree.
   * That is #(NV∩¬C)=40\#(NV \cap \lnot C) = 40.

Place that in the table:

|  | **Republican (R)** | **Democrat (D)** | **Did Not Vote (NV)** | **Row Total** |
| --- | --- | --- | --- | --- |
| **College (C)** | 100 | ? | ? | 400 |
| **No College (¬C\lnot C)** | 400 | ? | **40** | 600 |
| **Column Totals** | 500 | 450 | 50 | 1000 |

Now, in the **No College** row, the total must be 600. We currently have 400+40=440400 + 40 = 440 accounted for (Republican + Did Not Vote). Thus the Democrat cell for ¬C\lnot C is:

#(D∩¬C)=600−440=160.\#(D \cap \lnot C) = 600 - 440 = 160.

So we fill that in:

|  | **Republican (R)** | **Democrat (D)** | **Did Not Vote (NV)** | **Row Total** |
| --- | --- | --- | --- | --- |
| **College (C)** | 100 | ? | ? | 400 |
| **No College (¬C\lnot C)** | 400 | 160 | 40 | 600 |
| **Column Totals** | 500 | 450 | 50 | 1000 |

Similarly, in the **Did Not Vote** column total, we have 50 total nonvoters. We've already accounted for 40 of them in ¬C\lnot C, so there must be 50−40=1050 - 40 = 10 nonvoters in the **College** row:

#(NV∩C)=10.\#(NV \cap C) = 10.

So let’s place that in the table:

|  | **Republican (R)** | **Democrat (D)** | **Did Not Vote (NV)** | **Row Total** |
| --- | --- | --- | --- | --- |
| **College (C)** | 100 | ? | **10** | 400 |
| **No College (¬C\lnot C)** | 400 | 160 | 40 | 600 |
| **Column Totals** | 500 | 450 | 50 | 1000 |

Now for the **College** row: we have a total of 400, with Republican = 100 and Did Not Vote = 10. That adds up to 110, so the remainder who voted Democrat in the College row must be 400−110=290400 - 110 = 290:

#(D∩C)=290.\#(D \cap C) = 290.

Finally, we fill in that last missing cell:

|  | **Republican (R)** | **Democrat (D)** | **Did Not Vote (NV)** | **Row Total** |
| --- | --- | --- | --- | --- |
| **College (C)** | 100 | 290 | 10 | 400 |
| **No College (¬C\lnot C)** | 400 | 160 | 40 | 600 |
| **Column Totals** | 500 | 450 | 50 | 1000 |

This is our **completed cross‑tabulation**.

**5. Read Off the Probabilities**

Each “raw probability” is simply the cell (or row/column total) divided by the overall total 1,000. Conditional probabilities, e.g. Pr⁡(R∣¬C)\Pr(R \mid \lnot C), are read by dividing the relevant cell by the row total #(¬C)\#(\lnot C). Let’s verify the statements:

1. **Probability the respondent did not get a college degree**: Pr⁡(¬C)\Pr(\lnot C)

Pr⁡(¬C)=#(¬C)1000=6001000=0.60=60%.\Pr(\lnot C) = \frac{\#(\lnot C)}{1000} = \frac{600}{1000} = 0.60 = 60\%.

Matches the statement claiming 60%. That statement is **correct**.

1. **Probability the respondent voted Republican**: Pr⁡(R)\Pr(R)

Pr⁡(R)=#(R)1000=5001000=0.50=50%.\Pr(R) = \frac{\#(R)}{1000} = \frac{500}{1000} = 0.50 = 50\%.

Some statement claims 40%, but we see it's actually **50%**, so that 40% statement is **incorrect**.

1. **Probability the respondent voted Democrat**: Pr⁡(D)\Pr(D)

Pr⁡(D)=4501000=0.45=45%.\Pr(D) = \frac{450}{1000} = 0.45 = 45\%.

The statement claiming 45% is **correct**.

1. **Probability the respondent voted Republican, given they did not get a college degree**: Pr⁡(R∣¬C)\Pr(R \mid \lnot C)

Pr⁡(R∣¬C)=#(R∩¬C)#(¬C)=400600=0.666…≈66.67%.\Pr(R \mid \lnot C) = \frac{\#(R \cap \lnot C)}{\#(\lnot C)} = \frac{400}{600} = 0.666\ldots \approx 66.67\%.

The statement claiming 66.67% here is **correct**.

1. **Probability the respondent did not get a college degree, given they voted Republican**: Pr⁡(¬C∣R)\Pr(\lnot C \mid R)

Pr⁡(¬C∣R)=#(R∩¬C)#(R)=400500=0.80=80%.\Pr(\lnot C \mid R) = \frac{\#(R \cap \lnot C)}{\#(R)} = \frac{400}{500} = 0.80 = 80\%.

A statement saying 2/3 (≈66.67%) is **incorrect**; the correct value is 80%.

1. **Probability the respondent voted Democrat, given they do hold a college degree**: Pr⁡(D∣C)\Pr(D \mid C)

Pr⁡(D∣C)=#(D∩C)#(C)=290400=0.725=72.5%.\Pr(D \mid C) = \frac{\#(D \cap C)}{\#(C)} = \frac{290}{400} = 0.725 = 72.5\%.

A statement claiming 29% is **incorrect**; correct is 72.5%.

Hence, we have systematically **filled the table step by step** and read off each probability.