

This simulation follows on from CP571.

Bernoulli distribution

40% of drivers pass test first time.

0=fail, 1=pass.

Investigate what fraction of 90% confidence intervals constructed from sample proportions (n=25) contain the known population proportion of 0.4?

The z-score for a 90% CI is 1.645.

Simulate a random sample of 25 learner drivers and use mean to determine sample proportion.

Calculate the associated standard error.

Calculate the lower and upper bounds of the 90% confidence interval.

Judge whether the interval contains the known population proportion of 0.4.

Tap back on the top line and press EXE to repeat the simulation...

In Main, take a copy of the line to calculate the sample proportion and then start a new spreadsheet, pasting the formula into cell A1.

A1 =mean(randBin(1,0.4,25))

Calculator screenshot showing initial calculations for a 90% confidence interval. The display shows:

```

invNormCdf("C", 0.90, 1, 0)
    -1.644853627
mean(randBin(1, 0.4, 25))⇒p
    0.48
√(p×(1-p)/25) ⇒se
    0.09991996797
  
```

Calculator screenshot showing the calculation of lower and upper bounds and a TRUE result for the judge function. The display shows:

```

invNormCdf("C", 0.90, 1, 0)
    -1.644853627
mean(randBin(1, 0.4, 25))⇒p
    0.48
√(p×(1-p)/25) ⇒se
    0.09991996797
p-1.645×se⇒lo
    0.3156316527
p+1.645×se⇒hi
    0.6443683473
judge(lo<0.4<hi)
    TRUE
  
```

Calculator screenshot showing a different sample proportion and a FALSE result for the judge function. The display shows:

```

invNormCdf("C", 0.9, 1, 0)
    -1.644853627
mean(randBin(1, 0.4, 25))⇒p
    0.16
√(p×(1-p)/25) ⇒se
    0.07332121112
p-1.645×se⇒lo
    0.03938660771
p+1.645×se⇒hi
    0.2806133923
judge(lo<0.4<hi)
    FALSE
  
```

Spreadsheet screenshot showing the formula =mean(randBin(1,0.4,25)) entered in cell A1. The spreadsheet displays:

	A	B	C
1	0.48		
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

The formula bar shows: =mean(randBin(1,0.4,25))

In cells C1 and D1 calculate the lower and upper bounds of the 90% confidence interval.

In cell E1 judge if the interval contains the population proportion.

In cell B1 calculate the standard error based on the sample proportion.

$$B1 = (A1 * (1 - A1) / 25)^{(1/2)}$$

$$C1 = A1 - 1.645 * B1$$

$$D1 = A1 + 1.645 * B1$$

$$E1 = \text{judge}(C1 < 0.4 < D1)$$

Adjust the column widths - select columns A to E, tap Edit, Format, Column Width and enter a width of 50.

Make ten copies of the first row.

We'd expect 9 out of 10 TRUE's for a 90% confidence interval.

Use File, Recalculate to repeatedly examine how many of the ten intervals contain the population proportion.

You may want to File, Save your spreadsheet.

	A	B	C
1	0.48	0.09992	
2			
3			
4			
5			
6			

Formula bar: $=(A1 * (1 - A1) / 25)^{(1/2)}$

Bottom status bar: B1 0.09991996797

	C	D	E
1	0.31563	0.64437	TRUE
2			
3			
4			
5			
6			

Formula bar: $=\text{judge}(C1 < 0.4 < D1)$

Bottom status bar: E1 TRUE

	A	B	C	D	E
1	0.48	0.10	0.32	0.64	TRUE
2	0.16	0.07	0.04	0.28	FAL ..
3	0.56	0.10	0.40	0.72	TRUE
4	0.44	0.10	0.28	0.60	TRUE
5	0.36	0.10	0.20	0.52	TRUE
6	0.48	0.10	0.32	0.64	TRUE
7	0.36	0.10	0.20	0.52	TRUE
8	0.32	0.09	0.17	0.47	TRUE
9	0.32	0.09	0.17	0.47	TRUE
10	0.36	0.10	0.20	0.52	TRUE
11					
12					
13					
14					
15					
16					

Formula bar: $=\text{mean}(\text{randBin}(1, 0.4, 25))$

Bottom status bar: A10:E10

	C	D	E		
1	0.44	0.76	FAL ..		
2	0.32	0.64	TRUE		
3	0.36	0.68	TRUE		
4	0.44	0.76	FAL ..		
5	0.20	0.52	TRUE		
6	0.64	0.10	0.48	0.80	FAL ..
7	0.48	0.10	0.32	0.64	TRUE
8	0.56	0.10	0.40	0.72	TRUE
9	0.4	0.10	0.24	0.56	TRUE
10	0.44	0.10	0.28	0.60	TRUE
11					
12					
13					
14					
15					
16					

Formula bar: $=\text{mean}(\text{randBin}(1, 0.4, 25))$

Bottom status bar: A10:E10