**Randomness**

|  |  |
| --- | --- |
| http://upload.wikimedia.org/wikipedia/commons/1/19/4-sided_dice_250.jpg | Imagine rolling a non-biased tetrahedral die such as the one here 40 times. What might the 40 random outcomes be? Imagine now that instead of numbers, the die had different colours on each side.  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Blue** | **Green** | **Red** | **Yellow** |

Use the table below to record the results of 40 such rolls of the coloured die.

Try to be as random as possible.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Roll No. | Result | Roll No. | Result | Roll No. | Result | Roll No. | Result | Roll No. | Result |
| 1 |  | 9 |  | 17 |  | 25 |  | 33 |  |
| 2 |  | 10 |  | 18 |  | 26 |  | 34 |  |
| 3 |  | 11 |  | 19 |  | 27 |  | 35 |  |
| 4 |  | 12 |  | 20 |  | 28 |  | 36 |  |
| 5 |  | 13 |  | 21 |  | 29 |  | 37 |  |
| 6 |  | 14 |  | 22 |  | 30 |  | 38 |  |
| 7 |  | 15 |  | 23 |  | 31 |  | 39 |  |
| 8 |  | 16 |  | 24 |  | 32 |  | 40 |  |

Use this frequency table to record your results;

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Outcome | **Blue** | **Green** | **Red** | **Yellow** | Total |
| $$O\_{i}$$Observed Frequency |  |  |  |  |  |
| $$E\_{i}$$Expected Frequency |  |  |  |  |  |
| $$O\_{i}-E\_{i}$$ |  |  |  |  |  |
| $$\frac{\left(O\_{i}-E\_{i}\right)^{2}}{E\_{i}}$$ |  |  |  |  |  |

Perform a chi-squared test at the 5% level and at the 1% level to determine if this provides evidence of randomness.