a) It was an observational study. There was only one participant. Participants were not randomly assigned to high GMA/low GMA.

b) There is an association between GMA and dream bizarreness.

c) Ho: dream bizarreness is independent of GMA.

d) GMA → Melatonin → Dreams

e) The summary does not say whether the study was performed blind.

In this case, "blind" means that the dreams would be rated for bizarreness without knowing whether the GMA was high or low that night.

This would be important to reduce bias on the part of the person giving the (subjective) ratings to the dreams.

f) They are a sample of all dreams that occur during high GMA periods.

g) Ho: high GMA does not result in dreams that favor particular bizarreness ratings.

So Ho: dreams are uniformly distributed across bizarreness rating.
<table>
<thead>
<tr>
<th>Taking</th>
<th>observed</th>
<th>expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>total</td>
<td>85</td>
<td></td>
</tr>
</tbody>
</table>

\[
\chi^2 = \frac{(17-17)^2}{17} + \frac{(21-17)^2}{17} + \frac{(18-17)^2}{17} \\
+ \frac{(13-17)^2}{17} + \frac{(16-17)^2}{17}
\]

= 2.

Fully specified model \( \Rightarrow 5 - 1 = 4 \) d.o.f.

From table, p-value is between 90% and 70%

No evidence to reject the null hypothesis.

High GPA does not result in dreams that favors a poststructural bajounness rating.
(b) Test for independence

<table>
<thead>
<tr>
<th>Rating</th>
<th>High GMA</th>
<th>Low GMA</th>
<th>Expected Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>21</td>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>19</td>
<td>37</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>21</td>
<td>34</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>15</td>
<td>31</td>
</tr>
</tbody>
</table>

\[ \chi^2 = \frac{(17 - 11.6)^2}{11.6} + \frac{(21 - 17.1)^2}{17.1} + \frac{(18 - 20.4)^2}{20.4} + \frac{(13 - 18.8)^2}{18.8} \]
\[ + \frac{(16 - 17.1)^2}{17.1} + \frac{(4 - 9.4)^2}{9.4} + \frac{(10 - 13.9)^2}{13.9} + \frac{(19 - 16.6)^2}{16.6} \]
\[ + \frac{(21 - 15.2)^2}{15.2} + \frac{(15 - 13.9)^2}{13.9} \]
\[ = 12.56 \]

With a contingency table, \( (5-1) \times (2-1) = 4 \) degrees of freedom.

The p-value is between 5% and 1%.

Reject \( H_0 \) at 5% significance level.

Dream bizarreness is not independent of GMA.
a) Page number vs. number of pages viewed

b) No. cut-off at 0 long right tail

c) 95% CI for population mean is

\[
\text{Sample mean} \pm 2 \times \text{SE mean} \quad \text{SE}_{\text{mean}} = \sqrt{\frac{\# \text{draws} \times \text{SD}_{\text{box}}}{\text{V}}}
\]

\[
\text{SE}_{\text{mean}} = \frac{\text{SE}_{\text{sum}}}{\# \text{draws}} = \frac{\text{SD}_{\text{box}} \times \text{SD}_{\text{sample}}}{\sqrt{\# \text{draws}}}
\]

\[
= \frac{53.8}{\sqrt{235}} = 3.51
\]

\[
95\% \text{ CI is } 74.7 \pm 2 \times 3.51
\]

\[
67.7 \rightarrow 81.7
\]

d) No - the sample mean follows the normal curve irrespective of the distribution of the contents of the box. (Central limit theorem)
e) We do not know if the 1 covers the base mean.

f) No. The scatter diagram is not "football shaped".

g) Using regression:

\[ \text{Measure of } x = \frac{5-421}{0.7} = 1.29 \text{ SD above mean.} \]

Predict final score: \[ 69.6 + 0.32 \times 1.29 \times 12.3 \]
\[ = \frac{74.68}{1} \text{ SD y} \]

h) RMS error is \[ \sqrt{1-r^2} \cdot \text{SD y} \]
\[ = \sqrt{1-0.32^2} \times 12.3 = 11.65 \]

\[ 90 \pm 90 - 74.68 \]
\[ = 1.32 \text{ in \ standard units} \]

\[ \text{Shaded area is } \frac{1}{2} (180 - 81) = 9.5 \]
\[ = 9.5\% \text{ scored 90 or more.} \]
### a) Matrix A

<table>
<thead>
<tr>
<th></th>
<th>3</th>
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<th>3</th>
<th>3</th>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<td>x</td>
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<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

\[
p = \frac{24}{36} = \frac{2}{3}.
\]
d) \[ \begin{array}{c|ccccccc} & A & B & C & D & E & F & G \\ \hline 4 & 4 & 4 & 4 & 0 & 0 & 0 \\ S & \checkmark & \checkmark & \checkmark & \checkmark & \checkmark & \checkmark & \checkmark \\ S & \checkmark & \checkmark & \checkmark & \checkmark & \checkmark & \checkmark & \checkmark \\ S & \checkmark & \checkmark & \checkmark & \checkmark & \checkmark & \checkmark & \checkmark \\ 1 & x & x & x & x & x & x & \checkmark \\ 1 & x & x & x & x & x & \checkmark & \checkmark \\ 1 & x & x & x & x & \checkmark & \checkmark & \checkmark \\ \end{array} \]

\[ p = \frac{24}{36} = \frac{2}{3} \]

e) chance is 
\[ p(\text{you chose A and I roll higher}) \]
\[ + \ p(\text{you chose B and I roll higher}) \]
\[ + \ p(\text{you chose D and I roll higher}) \]

(addition rule as these are mutually exclusive)

\[ = p(\text{you chose A}) \times p(\text{I roll higher}) \quad \text{as independent} \]
\[ + \ p(\text{you chose B}) \times p(\text{I roll higher}) \]
\[ + \ p(\text{you chose D}) \times p(\text{I roll higher}) \]

\[ = \frac{1}{2} \times \frac{5}{9} = \frac{5}{18} \quad \text{(see above)} \]
\[ + \ \frac{1}{3} \times \frac{1}{3} \quad \text{from part b) this is } \frac{1}{3} \]
\[ + \ \frac{1}{3} \times \frac{1}{2} \quad \text{from part c) this is } \frac{1}{2} \]

\[ = \frac{7}{18} = \frac{1}{3} \times \frac{5}{9} + \frac{1}{3} \times \frac{1}{3} + \frac{1}{3} \times \frac{2}{3} \]
\[ = 0.52. \]
\[ P(\text{C beats A}) = \frac{20}{36} \]
\[ = \frac{5}{9} \]

\[ \begin{array}{ccccccc}
6 & 6 & 6 & 6 & 6 & & \\
\checkmark & \checkmark & \checkmark & \checkmark & \checkmark & & \\
\checkmark & \checkmark & \checkmark & \checkmark & \checkmark & & \\
\checkmark & \checkmark & \checkmark & \checkmark & \checkmark & & \\
\checkmark & \checkmark & \checkmark & \checkmark & \checkmark & & \\
\checkmark & \checkmark & \checkmark & \checkmark & \checkmark & & \\
\end{array} \]

**f) Sample size 20**

**Ho:** the content of the box is as given.

\[ Z = \frac{\text{obs} - \text{exp}}{\text{SE}} = \frac{2.4 - 2.5/3}{0.42} \]

\[ = -0.63 \]

*from table area \( \approx 0.46\% \)*

\[ Z = \frac{4 - 0}{\sqrt{\frac{3}{2} \times \frac{1}{3}}} \]

\[ = 0.42 \]

\[ \text{p-value} = \frac{1}{2} (100 - 46) = 24\% \]

we cannot reject Ho.

there is no reason to doubt my claim to be rolling die A.