1. $\frac{5!}{4!1!} \times \frac{52}{52} \times \frac{3}{51} \times \frac{2}{50} \times \frac{1}{49} \times \frac{48}{48}$
2. 600 rolls. The Law of Averages is working in your favor; a large number of draws will ensure the sample proportion is very close to the expected proportion of $162 / 3 \%$.
3. 60 times. With 600 rolls, the probability of any one specific value occurring is much smaller than when there are only 60 rolls.
4. Mean of box: $\frac{-10-5+0+1+3+7+9}{7}=\frac{5}{7}$

SD of box: deviances: $\frac{-75}{7} \frac{-40}{7}-\frac{5}{7} \frac{2}{7} \frac{16}{7} \frac{44}{7}$
Square: $\frac{5625}{49} \frac{1600}{49} \frac{25}{49} \frac{4}{49} \frac{256}{49} \frac{1936}{49} \frac{3364}{49}$
Mean: $\frac{1830}{49}$
$\mathrm{SD}=$ Root : 6.111
$\mathrm{EV}=100 \times \frac{5}{7}=71.43$
$\mathrm{SE}=\sqrt{100} \times 6.11=61.11$
5. New box: $\left[\begin{array}{lllllll}1 & 1 & 0 & 0 & 0 & 0 & 0\end{array}\right]$

Mean of box: $\frac{2}{7}$
SD of box: $(1-0) \sqrt{\frac{2}{7} \times \frac{5}{7}}=0.452$
$\mathrm{EV}=400 \times \frac{2}{7}=114.29$
$\mathrm{SE}=\sqrt{400} \times 0.452=9.04$
6. Box: [10]

Mean of box: 0.5
SD of box: $(1-0) \times \sqrt{0.5 \times 0.5}=0.5$
$\mathrm{EV}=6 \times 0.5=3$
$\mathrm{SE}=\sqrt{6} \times 0.5=1.225$
$z=\frac{3.5-3}{1.225}=0.41$
Chance $=\frac{100 \%-31.08 \%}{2}=34.46 \%$
7. Mean of box: 0.36

SD of box: $(1-0) \times \sqrt{0.36 \times 0.64}=0.48$
$\mathrm{EV}=100 \times 0.36=36$
$\mathrm{SE}=\sqrt{100} \times 0.48=4.8$
8. Mean of box: 0.04

SD of box: $(1-0) \times \sqrt{0.04 \times 0.96}=0.196$
$\mathrm{EV}=4 \%$
$\mathrm{SE}=\frac{0.196}{\sqrt{25}} \times 100 \%=3.9 \%$
The confidence interval cannot be constructed. Going two SEs below the EV gives a negative proportion, which is not a possible value.
9. Null: The box contains $50 \%$ red balls, $45 \%$ blue balls, and $5 \%$ white balls.

Alt: The box contains some other proportion of the colors.
Expected reds: $25 \times .5=12.5$
Expected blues: $25 \times .45=11.25$
Expected whites: $25 \times 0.5=1.25$

$$
\begin{aligned}
& \chi^{2}=\frac{(15-12.5)^{2}}{12.5}+\frac{(9-11.25)^{2}}{11.25}+\frac{(1-1.25)^{2}}{1.25}=1 \\
& 3-1=2 \text { d.f. }
\end{aligned}
$$

$50 \%<p<70 \%$ is not significant at the $5 \%$ level, so we fail to reject the null hypothesis. It looks like the draws could come from the box described.
10. False. The SE was calculated using methods suitable for a simple random sample. This is not a simple random sample.
11. It's not a good estimate, due to selection bias. The only people included in this sample are people who (1) watch this program and (2) cared enough to call in.
12. True. Those are the correct calculations and interpretation for a simple random sample.
13. Box has 13 ones and 39 zeroes.

Mean of box: 0.25
SD of box: $(1-0) \sqrt{.25 \times .75}=0.433$
$\mathrm{EV}=13 \times .25=3.25$
$\mathrm{SE}=\sqrt{\frac{52-13}{52-1}} \times \sqrt{13} \times 0.433=1.365$
$z=\frac{4.5-3.25}{1.365}=0.90$
Chance $=\frac{100 \%-63.19 \%}{2}=18.405 \%$
14. Null: The data are like 60 draws at random with replacement from a box with 1 one and 5 zeroes.

Alt: The box has a larger proportion of ones.
Mean of box: $\frac{1}{6}$
SD of box: $(1-0) \times \sqrt{\frac{1}{6} \times \frac{5}{6}}=.3727$
EV: $60 \times \frac{1}{6}=10$
SE: $\sqrt{60} \times .3727=2.887$
$z=\frac{15-10}{2.557}=1.95$

$$
p=\frac{100 \%-94.88 \%}{2}=2.56 \%
$$

p is significant at the $5 \%$ level, so we reject the null hypothesis. It looks like there are too many fours.
15. Null: The data are like 60 draws at random with replacement from a box with equal proportions of $1,2,3,4,5$, and 6 .

Alt: The box has some other proportions of the values.

$$
\begin{aligned}
& \chi^{2}=\frac{(9-10)^{2}}{10}+\frac{(8-10)^{2}}{10}+\frac{(9-10)^{2}}{10}+\frac{(15-10)^{2}}{10}+\frac{(10-10)^{2}}{10}+\frac{(9-10)^{2}}{10}=3.2 \\
& \text { d.f. }=6-1=5
\end{aligned}
$$

$50 \%<p<70 \%$ is not significant at the $5 \%$ level, so we fail to reject the null hypothesis. It looks like the die is fair.

