

Math 1431
Spring 2003 – Test #2 – Answers

Name _____

You are allowed to use your calculator. Explain all answers – answers with no explanation will receive only partial credit. Use complete sentences. Show how you used the calculator to answer the questions below.

1. (30 points) Let X be the sum of the random roll of one fair six-sided dice and one fair four-sided dice. Find the following probabilities:

- a. The probability of rolling a sum greater than 3.
b. $P(X \leq 5)$. c. $P(X > 7)$. d. $P(X = 6)$. e. $P(X = 8)$

ANS: Here is the sample space ($n = 24$):

$1 + 1 = 2$	$1 + 2 = 3$	$1 + 3 = 4$	$1 + 4 = 5$	$1 + 5 = 6$	$1 + 6 = 7$
$2 + 1 = 3$	$2 + 2 = 4$	$2 + 3 = 5$	$2 + 4 = 6$	$2 + 5 = 7$	$2 + 6 = 8$
$3 + 1 = 4$	$3 + 2 = 5$	$3 + 3 = 6$	$3 + 4 = 7$	$3 + 5 = 8$	$3 + 6 = 9$
$4 + 1 = 5$	$4 + 2 = 6$	$4 + 3 = 7$	$4 + 4 = 8$	$4 + 5 = 9$	$4 + 6 = 10$

- a. $P(X > 3) = 21/24 = 7/8$
b. $P(X \leq 5) = 10/24 = 5/12$
c. $P(X > 7) = 6/24 = 1/4$
d. $P(X = 6) = 4/24 = 1/6$
e. $P(X = 8) = 1 - P(x = 8) = 1 - 3/24 = 21/24 = 7/8$

2. (30 points) Abby, Betty, Candler and Dave work together in an office. Their employer must choose two of them to attend a conference. To avoid unfairness, the choice will be made by constructing an SRS of size 2.

- a. Show how you can randomly select the two workers using your calculator.
b. Write down the sample space (i.e., all possible combinations of two names).
c. What is the probability that Abby or Betty is chosen?
d. What is the probability that Dave is chosen?
e. What is the probability that Betty is not chosen?

ANS:

- a. To randomly select 2 people on the TI-83, label Abby as 1, Betty as 2, Candler as 3 and Dave as 4. Then use $\text{randInt}(1, 4, 2)$ as the random number generator.
b. The sample space is $\{AB, AC, AD, BC, BD, CD\}$ and $n = 6$.
c. $P(A \text{ or } B) = 5/6$.
d. $P(D) = 1/2$.
e. $P(\text{not } B) = 1/2$.

3. (10 points) A bottling company uses a filling machine to fill plastic bottles with cola. The bottles are supposed to contain 300 ml. In fact, the contents vary according to a normal distribution with mean 298 ml and standard deviation 3 ml.

- a. What is the probability that an individual bottle contains less than 295 ml?
b. What is the probability that the mean contents of the bottles in a six-pack is less than 295 ml?
c. Is 298 ml a parameter or a statistic?

ANS:

- a. Use NDAREA on TI-83 with mean 298 and standard deviation 3: $P(\text{less than } 295) = 0.159$.
b. Use NDAREA on TI-83 with mean 298 and standard deviation $3/\sqrt{6}$ (since this is a sample of the population): $P(\text{less than } 295) = 0.007$.
c. 298 is a parameter, the mean of the population.

4. (10 points) Red, blue, yellow and green marbles are in a box. Here are the approximate probabilities that a marble chosen at random will have a given color.

Color	Red	Blue	Yellow	Green
Probability	0.34	0.27	0.20	?

- What is the probability that a marble chosen is green?
- What is the probability that a marble chosen is blue, green or yellow?

ANS:

$$P(\text{green}) = 1 - P(\text{red, blue or yellow}) = 1 - (0.34 + 0.27 + 0.20) = 0.19$$

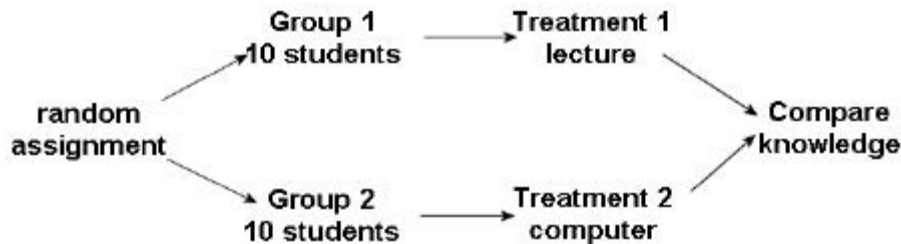
$$P(\text{blue, green or yellow}) = P(\text{blue}) + P(\text{green}) + P(\text{yellow}) = 0.27 + 0.19 + 0.20 = 0.66.$$

5. (20 points) An educator wants to compare two methods of teaching statistical mechanics. One method is the use of computer simulation and the other method is lecture. He randomly divides the students into two groups. One group of ten students only uses the computer and the other group attends only lectures. At the end of the instructional unit, he tests and compares the students' knowledge.

- Sketch the design.
- What are the experimental units?
- What are the explanatory and response variables?
- What are the factors and their levels?

ANS:

a.



- The experimental units are the 20 students.
- The explanatory variables are the lecture and computer simulation. The response variable is the knowledge of statistical mechanics.
- The factors are the lecture and computer simulation with one level each.

Extra Credit

6. (2 points) What theorem states that when a sample of size n is drawn from any population with mean μ and standard deviation σ , with n sufficiently large, then the distribution of the sample mean is approximately normal with mean μ and standard deviation σ/\sqrt{n} ?

ANS: The central limit theorem.