Review questions
MTH 23.5, Fall 2024
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1. For the following data
$$47 \quad 49 \quad 50 \quad 51 \quad 52 \quad 53 \quad 56 \quad 56 \quad 57 \quad 59.$$
   (a) Find the sample mean x.
   (b) Find the sample standard deviation s.

2. Find the sample standard deviation for the data

x	1	2	3	4	5	6	7	8	9	10
f	384	208	98	56	28	12	8	2	3	1

3. The following data represent the duration (in days) of U.S. space shuttle voyages for the years 1992-94.
$$8 \quad 9 \quad 9 \quad 14 \quad 8 \quad 8 \quad 10 \quad 7 \quad 6 \quad 9 \quad 7 \quad 8 \quad 10 \quad 14 \quad 11 \quad 8 \quad 14 \quad 11$$
   (a) Find the mode.
   (b) Find the the median.
   (c) Find the first and the third quartile.
   (d) What is the percentile rank of 7?

4. The following table summarizes the exam scores of 100 students.

Score	Frequency
$49.5 - 59.5$	5
$59.5 - 69.5$	10
$69.5 - 79.5$	30
$79.5 - 89.5$	40
$89.5 - 100$	15

   (a) Find the relative frequency of each grade range.
   (b) Construct a relative frequency histogram.

5. Anna and Benjamin took the same Statistics course, Anna in the fall, Benjamin o in the spring. Anna's score on the final exam was 79, and on that exam the mean was 72 and the standard deviation 7. Benjamin's score on the final exam that he took was 82, and on that exam the mean was 74 and the standard deviation 10.
   (a) Who did relatively better, Anna or Benjamin?
   (b) What score in Anna's version of the exam, does Benjamin score correspond to?

6. The distribution of the scores of the MTH 23 final exam over the last 10 years is roughly bell shaped and has a mean of 72 and the standard deviation 6.
   (a) Approximately what percentage of students scores above 84 in the MTH 23 final?
   (b) If 200 students take the final exam this semester, about how many will score below 66?

7. In a class of 80 students the professor announced that the mean numerical grade was 74 with a standard deviation of 9. In the chat group of the class 10 different students claimed that they got an $\mathbb{A}+$, which means numerical grade between 93 and 97.
   (a) Explain why some of them are lying about their grade.
   (b) At least how many are lying?

8. An animal shelter has a 60% adoption rate for puppies. Of all puppies in the shelter, 75% live to be 6 years or older. Of the puppies who are adopted, 87% live to be 6 years or older.
   (a) What is the probability that a randomly selected puppy in the shelter will get adopted **and** live 6 or more years?
   (b) What is the probability that a randomly selected puppy in the shelter will get adopted **or** live 6 or more years?

9. Maria is applying for a job. The application consists of two steps. In the first step she has to submit a written application, and then to be interviewed by a hiring committee. 65% of the written applications are approved, and 60% of the applicants pass the hiring committee interview. We also know that 80% of those whose written application has been approved, pass the interview by the hiring committee.

   (a) What is the probability that Maria's written application is approved **and** she passes the hiring committee interview?
   (b) What is the probability that Maria's written application is approved **or** she passes the hiring committee interview?

10. A tourist who speaks English and German but no other language visits a region of Slovenia. If 35% of the residents speak English, 15% speak German, and 3% speak both English and German, what is the probability that the tourist will be able to talk with a randomly encountered resident of the region?

11. The following table relates the weights and heights of a group of individuals participating in an observational study.

	Tall	Medium	Short	TOTAL
Obese	18	28	14	
Normal	20	51	28	
Underweight	12	25	9	
TOTAL				

   (a) Find the total for each row and column.
   (b) Find the probability that a randomly chosen individual from this group is Tall.
   (c) Find the probability that a randomly chosen individual from this group is Tall **given** that the individual is Obese.
   (d) Are the events Obese and Tall independent?
   (e) Find the probability group is Obese **or** Tall.
   (f) Find the probability that a randomly chosen individual from this group is **not** Obese.

12. The sample space of equally likely outcomes for the experiment of rolling two fair dice is

$$
\begin{array}{cccccc}
11 & 12 & 13 & 14 & 15 & 16 \\
21 & 22 & 23 & 24 & 25 & 26 \\
31 & 32 & 33 & 34 & 35 & 36 \\
41 & 42 & 43 & 44 & 45 & 46 \\
51 & 52 & 53 & 54 & 55 & 56 \\
61 & 62 & 63 & 64 & 65 & 66
\end{array}
$$

   Let N be the event "the sum is at least nine", T be the event "at least one of the dice is a two", and F be the event "at least one of the dice is a five".

   (a) List the outcomes that comprise each of the events N, T, and F.
   (b) Find $P(N)$.
   (c) Find $P(N$ **given** $F)$.
   (d) Find $P(N$ **given** $T)$.
   (e) Determine from the previous answers whether or not the events N and F are independent; whether or not N and T are.

13. A manufacturer examines its records over the last year on a component part received from outside suppliers. The breakdown on source (supplier A, supplier B) and quality, (High, Usable, or Defective) is shown in the two-way contingency table.

	High	Usable	Defective	TOTAL
Supplier A	0.6937	0.0049	0.0014	
Supplier B	0.2982	0.0009	0.0009	
TOTAL				

The record of a part is selected at random. Find the probability of each of the following events.

  (a) The part was defective.

  (b) The part was either of high quality or was at least usable.

  (c) The part was defective and came from supplier B.

  (d) The part was defective or came from supplier B.

14. A survey of the customers of an ice cream shop found that 70% like chocolate flavor, 45% like vanilla flavor, and 30% like both. If we randomly select a customer what is the probability that

  (a) they like either chocolate or vanilla flavored ice cream.

  (b) They don't like either flavor.

  (c) They like vanilla flavor given that they like chocolate flavor.

15. The sample space that describes all three-child families according to the genders of the children with respect to birth order is

$$S = \{\text{BBB}, \text{BBG}, \text{BGB}, \text{BGG}, \text{GBB}, \text{GBG}, \text{GGB}, \text{GGG}\}$$

In the experiment of selecting a three-child family at random, compute each of the following probabilities, assuming all outcomes are equally likely.

  (a) The probability that the family has at least two boys.

  (b) The probability that the family has at least two boys, given that not all of the children are girls.

  (c) The probability that at least one child is a boy.

  (d) The probability that at least one child is a boy, given that the first born is a girl.

16. Suppose for events A and B in a random experiment $P(A) = 0.70$ and $P(B) = 0.30$. Compute the indicated probability, or explain why there is not enough information to do so.

  (a) $P(A$ **and** $B)$.

  (b) $P(A$ **and** $B)$, with the extra information that A and B are independent.

  (c) $P(A$ **and** $B)$, with the extra information that A and B are mutually exclusive.