

Praxis Core Academic Skills for Educators

Math Review

Statistics and Probability

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Statistics and Probability

TOPICS

Data Representation

- *Tables*
- *Bar Graphs*
- *Line Graphs*
- *Pie Charts*
- *Stem-and-Leaf Plots*
- *Box-and-Whisker Plots*
- *Venn Diagrams*
- *Scatter Plots*
- *Line Plots*

Probability

- *Likelihood of an Event*
- *Complements*

Analyzing Data

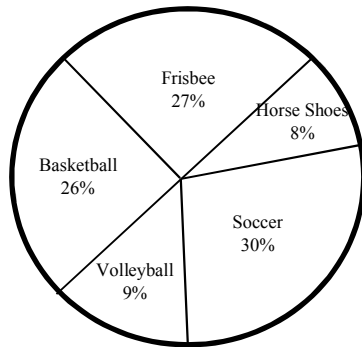
- *Range*
- *Mean*
- *Median*
- *Mode*
- *Variability*
- *Linear Models*

Scientific Notation

Statistics and Probability

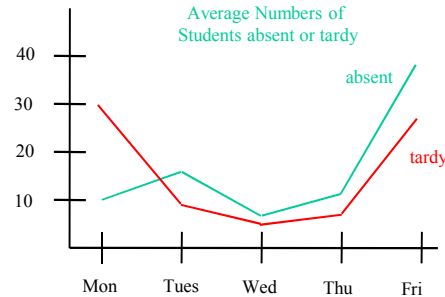
Data Interpretation

Favorite Sport Poll of 1200 People



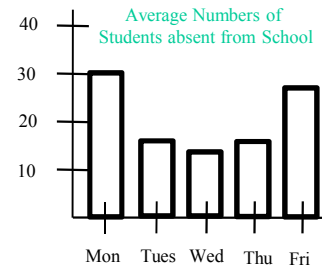
**Circle Graphs
(pie charts)**

Used to show “part of a whole”.
Often used to illustrate percentages.



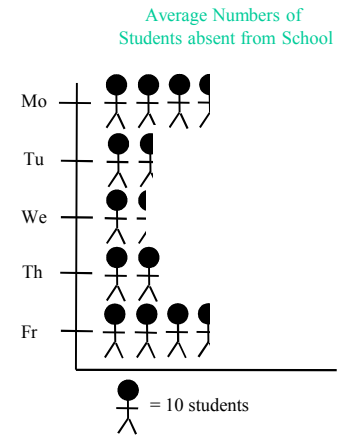
Line Graphs

Can be a single or multiple lines used to illustrate discrete values on an x/y graph



Bar Graphs

Uses “bars” to illustrate discrete values



Pictographs

Uses complete or partial figures to illustrate discrete values. Typically illustrate fractions poorly

- Problem 1:** Using the Circle Graph above, which sport is the most popular? Least popular?
- Problem 2:** Using the Line Graph above, on which day of the week are most students likely to be absent?
Are there any days in which there are typically more students tardy than absent?
On what day was the difference between absent students and tardy students the greatest?
- Problem 3:** Using the Bar Graph above, is it different than the corresponding graph in the Line Graph?
Estimate the average total number of absences per week. Make a table from this graph.
- Problem 4:** Using the Pictograph above, Estimate the average number students absent on a Tuesday?

Statistics and Probability

Data Interpretation

Jim's Vegetable Garden

Plant	Number of Plants
Peppers	9
Cabbage	16
Tomato	12
Broccoli	9

Tables

Used to show data in categories. Organized in Rows and Columns.

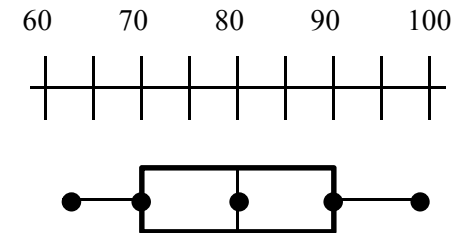
Biology Test Scores

Stem	Leaf
6	1 2 4 8
7	3 3 7
8	2 5 5 5 9
9	1 3 9

Key: 5|0 means 50

Stem-and-Leaf Plots

Represents an ordered list of data. The leaf is the last digit and the stem is all other digits.



Box-and-Whisker Plots

Uses "bars" to illustrate discrete values

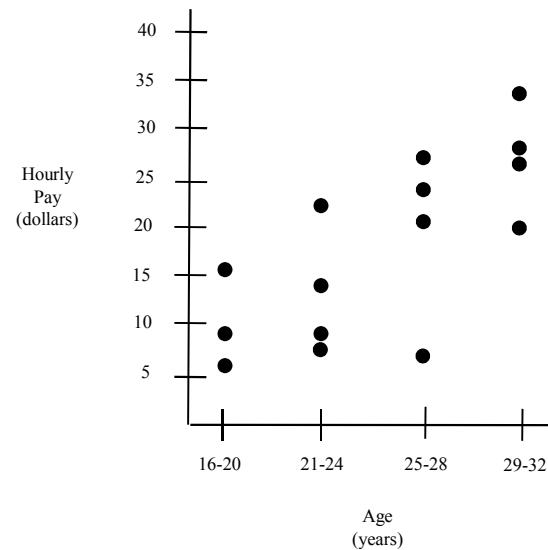
Problem 1: Using the Table, What vegetable has the most plants? How many Pepper Plants are there?

Problem 2: Using the Stem-and-Leaf Plot, what is the highest grade? What was the median grade? Did any student get a score or 84?

Problem 3: Using the Bar Graph above, is it different than the corresponding graph in the Line Graph? Estimate the average total number of absences per week. Make a table from this graph.

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Scatter Plots



This plot shows the scatter plot of the hourly pay of 15 people of with ages ranging from 16 to 32.

Problem 1: What is the median hourly pay of individuals in the 16-20 year range? What is the overall median pay?

Problem 2 : Make a table corresponding to the above scatter plot.

Statistics and Probability

Statistics

Range: *The difference between the largest and smallest values*

Example: given $A = \{2, 4, 6, 8, 10, 13\}$, the range of the elements in A is 11 ($13-2$)

Arithmetic Mean : *Average of a list of values*
$$\frac{\text{Sum of the list of values}}{\text{Number of values in the list}}$$

Example: given $A = \{2, 4, 6, 8, 10, 12\}$, the average of the elements in A is 7 ($42/6$)

Median: *Value in the middle*

NOTE: *Need to order the value before finding the median*

Example: given $A = \{14, 3, 12, 43, 34, 17, 55\}$, the median of the elements in A is 17

NOTE: *If the number of elements is even, take average of two middle elements*

Example: given $B = \{14, 3, 12, 43, 34, 17\}$, the median of the set B is 15.5 ($(14+17)/2$)

Mode: *Value that appears the most times*

NOTE: *multiple modes may appear*

Example: given $C = \{2, 3, 3, 5, 2, 6, 7, 6, 1, 2, 3\}$, the mode of the set C is 2 and 3

Problem 1: Given the set of numbers $\{1, 3, 4, 5, 7, 4, 3, 3, 2, 5, 15, 7, 13\}$, find the Range, Mean, Median and Mode.

Problem 2: Given the set of numbers $\{3, 4, 5, 7, 4, 3, 12, 2, 5, 15, 7, 13\}$, find the Range Mean, Median and Mode.

Statistics and Probability

Outlier

a data element that is much different than the typical element

example:

*The scores on a biology test were:
85, 87, 80, 78, 32, 84, 83, 80 and 91*

32 is an outlier because it is
much smaller than the typical
score

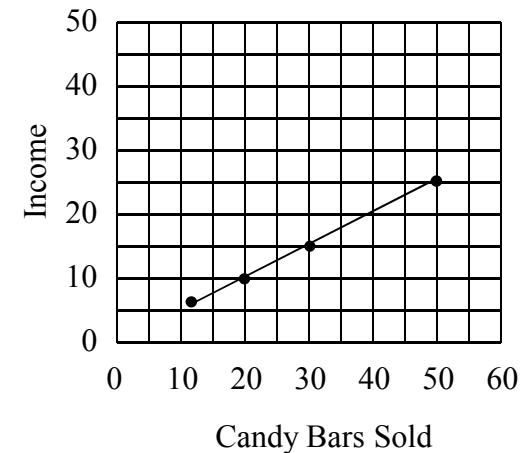
To check for Outliers,
put the data in numeric order and look
to see if any element is far away from
the rest

Linear Models

when the data forms a straight line

example:

Candy Bars Sold	Income
12	\$6
20	\$10
30	\$15
50	\$25



The graph of the table makes a straight line

Problem 2: Does the set $A = \{43, 42, 40, 95, 39, 40, 45, 44\}$ contain any outliers? If yes, what are they?

Problem 3: Do the ordered pairs $\{(2, 8), (3, 12), (5, 20), (8, 32), (12, 48)\}$ represent a linear model?

Problem 4: Which ordered pair in the set $B = \{(3, 15), (5, 30), (8, 40), (9, 45), (12, 60)\}$ prevent it being a linear model?

Statistics and Probability

Probability

The probability of an event is always between 0 and 1

A probability of 0 implies that the event CANNOT occur

A probability of 1 implies that the event will ALWAYS occur

Example: find the probability of rolling a “3” on a single die

There are six possible “rolls” – 1, 2, 3, 4, 5 or 6 - Therefore the probability is 1 out of 6 or 1/6

Independent Events : *Two events are independent if their outcomes have no effect on each other*

Example: *What is the probability of heads on three consecutive flips of a coin*

The probability of each flip is .5, so the probability of three consecutive is $.5 \times .5 \times .5 = .125$

Dependent Events : *Two events are dependent if the outcome of the first effects the other*

Example: *What is the probability of selecting two cards from a deck, both Kings?*

The probability of the first King is 4 out of 52, but when selecting the second card, there are only 51 cards left and only three Kings if the first card was a King, therefore the probability is 3 out of 51. So the overall probability is

$$\frac{4}{52} \times \frac{3}{51} = \frac{3}{663}$$

The **complement** of an event is the likelihood that the event will **NOT** occur

Problem 1: What is the probability of rolling two consecutive even numbers with a single die?

Problem 2: What is the probability of selecting two cards from different suits from a deck of cards?

Statistics and Probability

Scientific Notation

An easier way to write very large or very small numbers
by moving the decimal point to remove most of the zeros

Examples:

$$57,000,000,000,000 = 5.7 \times 10^{13}$$

*moved decimal point
13 places to the left*

$$0.000000035 = 3.5 \times 10^{-8}$$

*moved decimal point
8 places to the right*

STEPS

1. move the decimal point to make a number between 1 and 10
2. count the number of places the decimal point moved
3. if moved to the **right** the exponent will be **negative**
if moved to the **left** the exponent will be **positive**

450,000

*move decimal point
5 places to the left*

4.5×10^5

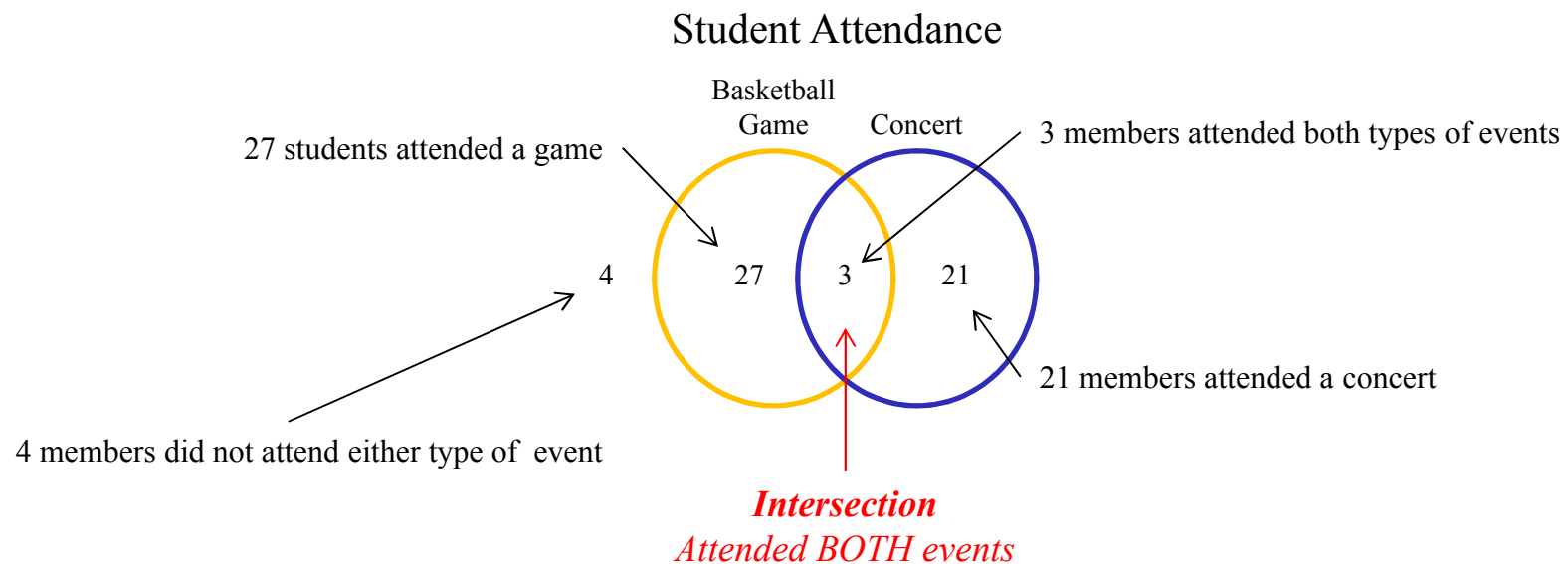
Problem 1: Convert 874,000,000 to Scientific Notation.

Problem 2: Convert 0.000004 to Scientific Notation.

Statistics and Probability

Venn Diagrams

An graphical way to represent relationships between different groups of things using shapes such as circles or ovals.



Problem 1: Using the above Venn Diagram, how many students were there? How many students attended a Basketball Game?