Probability & Histograms

Week 7 (6/1 - 6/5):

NOTES:

Example of Probability:

What is the probability that Kevin will select a red from a bag of marbles containing 3 yellow, 5 red and 2 blue?

Sample space

$P(\text{red}) = \frac{5}{10} = \frac{1}{2} = 0.5 = 50\%$

0.5, 0.5

Probability of

Event

Outcome

Topic: ***Determine*** *the theoretical probability of an event.*

NOTES:

Theoretical Probability

Theoretical Probability of an event is the ratio of the number of favorable outcomes to the total number of outcomes.

Favorable outcomes are outcomes in a specified event. What are they asking you the probability of?

Theoretical Probability

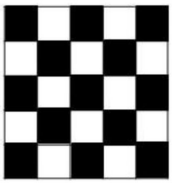
For equally likely outcomes,

$$P(\text{event}) = \frac{\text{number of favorable outcomes (events)}}{\text{number of outcomes in the sample space}}$$

Examples:

Each letter of the word PROBABLE is written on a separate card. The cards are placed face down and mixed up. What is the theoretical probability that a randomly selected card is a B? $TP(B) = \frac{2}{8} \div \frac{2}{2} = \frac{1}{4} = 25\%$	A fair number cube has the numbers 1, 2, 3, 4, 5, and 6. What is the theoretical probability of rolling an odd number? $TP(\text{odd}) = \frac{3}{6} \div 3 = \frac{1}{2} = 50\%$

1. Ronnie is playing darts with his friends. What is the probability that his dart will land in a shaded square?



$P(\text{shaded}) = \frac{\square \text{ \# of shaded parts}}{\square \text{ Total number of parts}}$

A	$\frac{10}{25}$	B	$\frac{11}{25}$
C	$\frac{12}{25}$	D	$\frac{13}{25}$

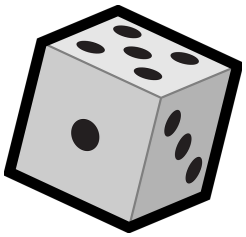
2. A fair-sided coin lands on heads 150 times and on tails 120 times. What is the **theoretical probability** that the next time the coin is flipped it will land on tails? Express your answer as a fraction in simplest form.

OMIT

Fraction:	Simplest Form Fraction:
T(Tails) =	

Hint: There's information in the problem we DO NOT need! Be careful! Theoretical probability deals with the coin itself; not the number of times it was flipped.

3. What is the theoretical probability of landing on an even number when rolling a six-sided number cube?



$$P(\text{even}) = \frac{\square \text{ \# of even numbers}}{\square \text{ Total number of sides}}$$

Topic: ***Determine*** *the experimental probability of an event.*

NOTES:

Experimental Probability

You can estimate the probability of an event by using data, or by experiment. For example, if a doctor states than an operation "has an 80% probability of success", 80% is an estimate of probability based on similar case histories.

The experimental probability of an event is the ratio of the number of times that the event occurs, the *frequency*, to the number of trials.

Experimental Probability

$$\text{experimental probability} = \frac{\text{number of times the event occurs}}{\text{number of trials}}$$

Each repetition of an experiment is a trial.

Examples:

The table shows the results of a spinner experiment.

Spinner Number	Frequency
1	6
2	11
3	19
4	14

Total = 50

Find the experimental probability of spinning a 4.

$EP(4) = \frac{14 \div 2}{50 \div 2} = \frac{7}{25} = 28\%$

The table shows the results of choosing one card from a deck of cards, recording the suit, and then replacing the card.

Card Suit	Frequency (Exp.)
Hearts	5
Diamonds	9
Clubs	7
Spades	5

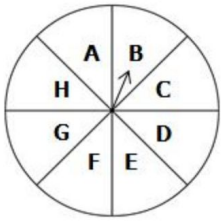
Total = 26

What is the experimental probability of choosing a diamond?

$EP(\text{diamond}) = \frac{9}{26} = 35\%$

4. This spinner has 8 sections of equal size. The arrow of this spinner was spun 24 times and landed on the letter B four times. What is the **experimental probability** the arrow will land on the letter B?

OMIT



$P(B) = \frac{\square}{\square}$ — numerator: *# of times the spinner landed on B*; denominator: *Total number of spins*

A	$\frac{1}{6}$	B	$\frac{1}{8}$
C	$\frac{1}{2}$	D	$\frac{1}{24}$

5. A standard coin has two sides. One side is heads and one side is tails. A coin is tossed 75 times. If the coin lands on heads 35 times, what is the **experimental probability**?

$P(Heads) = \frac{\square}{\square}$ — numerator: *# of times the spinner landed on heads*; denominator: *Total number of tosses*

A	$\frac{1}{15}$	B	$\frac{9}{15}$
C	$\frac{3}{5}$	D	$\frac{7}{15}$

6. What is the experimental probability of drawing a red marble from the data given below?

Molly's Sack of Marbles

Color	Number Of Marbles
Red	8
Yellow	7
Green	6
Blue	5
Purple	4

$P(Red) = \frac{\square}{\square}$ — numerator: *# of times a red marble was selected*; denominator: *Total number of marble selections*

A	$\frac{1}{15}$	B	$\frac{4}{15}$
C	$\frac{1}{5}$	D	$\frac{2}{15}$

Topic: ***Investigate and describe*** *the difference between the probability of an event found through experiment or simulation versus the theoretical probability of that same event.*

NOTES:

Comparing Theoretical & Experimental Probabilities

1. Billy picks one card at a time from a bag and replaces it. He repeats this process 12 times and records the results in the table.

Theo (out of 4) → Exp (out of 12)

Letters	Frequency
A	3
B	4
C	2
D	3

Calculate and compare the theoretical and experimental probabilities of selecting a C.

Theoretical $P(C) = \frac{1}{4} = 25\%$.

Experimental $P(C) = \frac{2}{12} = \frac{1}{6} = 17\%$.

- The theoretical probability is greater than the experimental probability.

7. Several students conducted a simulation where a standard coin was tossed several times and the results were recorded in a table. Which table shows an <u>experimental probability of landing on tails</u> that is ***closest to*** the <u>theoretical probability of landing on tails</u>?

A

Coin Toss	
Heads	35
Tails	32

TP(Tails) = $\frac{\square}{\square}$ = _____%

# of tails on a coin

Total number of sides on a coin

EP(Tails) = $\frac{\square}{\square}$ = _____%

# of times the coin landed on tails

Total number of tosses

B

Coin Toss	
Heads	27
Tails	18

TP(Tails) = $\frac{\square}{\square}$ = _____%

# of tails on a coin

Total number of sides on a coin

EP(Tails) = $\frac{\square}{\square}$ = _____%

# of times the coin landed on tails

Total number of tosses

C

Coin Toss	
Heads	78
Tails	64

TP(Tails) = $\frac{\square}{\square}$ = _____%

# of tails on a coin

Total number of sides on a coin

EP(Tails) = $\frac{\square}{\square}$ = _____%

# of times the coin landed on tails

Total number of tosses

D

Coin Toss	
Heads	11
Tails	8

TP(Tails) = $\frac{\square}{\square}$ = _____%

# of tails on a coin

Total number of sides on a coin

EP(Tails) = $\frac{\square}{\square}$ = _____%

# of times the coin landed on tails

Total number of tosses

Week 8 (6/8 - 6/12):

NOTES:

Histogram Basics

Parts of a Histogram

1. Title: The title briefly describes the information that is contained in the histogram.

2. X-axis: The horizontal (*x*-axis) shows you the scale of values into which the measurements fit. These measurements are generally grouped into **intervals** to help you summarize large data sets.

3. Bars: The bars have two important characteristics – **height** and width. The height represents the number of times the values within an interval occurred. The width represents the length of the interval covered by the bar. (It is the same for all bars!)

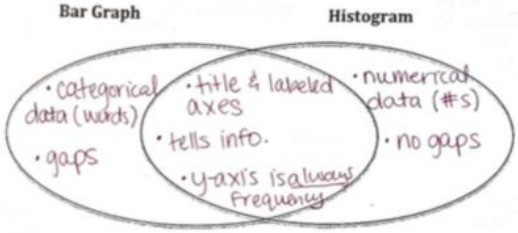
4. y-axis: The vertical (*y*-axis) is the scale that shows you the number of times the values within an interval occurred. The number of times is also referred to as "**frequency**."

2

Histogram Basics

Histogram: A bar graph that shows the number of times data occur within certain ranges or intervals.

Interval: Period of time.

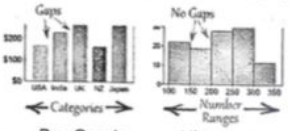


Complete "Charting the Difference" Activity

Histograms are a great way to show results of *continuous data*, such as:

- Weight
- Height
- How much time...

The main difference between histograms and bar graphs...



3

Creating A Histogram

- ☐ **Step 1:** Make a table with 3 separate columns
  - Intervals
  - Tallies
  - Frequency
- ☐ **Step 2:** Complete table using data
- ☐ **Step 3:** Label the horizontal (*x*-axis) **intervals**
- ☐ **Step 4:** Label the vertical (*y*-axis) **frequency**
- ☐ **Step 5:** Plot the data
- ☐ **Step 6:** Add a title and legend (if necessary)

Use the data below to create a histogram:

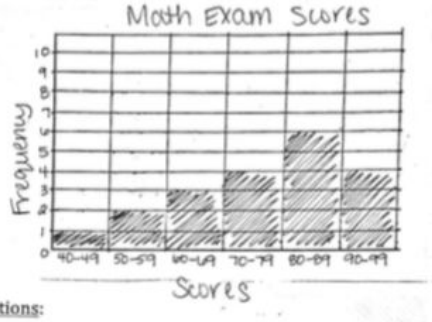
The following are student scores for the last math exam.

97	92	88	75
85	67	89	55
72	78	81	91
51	68	67	74
87	84	98	46

Intervals	Tallies	Freq.
40-49	|	1
50-59	||	2
60-69	|||	3
70-79	||||	4
80-89	|||| |	6
90-99	||||	4
		20

4

Creating A Histogram



Questions:

1. Which interval did most people earn on the test?
   80-89
2. How many students earned a score less than 70?
   3 + 2 + 1 = 6 students
3. Based on the scores above, choose the most accurate inference.
   a. It is likely the students grasped the concepts being tested.
   b. It is unlikely the students grasped the concepts being tested.
4. If another student took the same math exam, which interval would the student most likely score, based on the above histogram?
   80-89
5. If a passing score is 70 or above, how many passed the math exam?
   4 + 6 + 4 = 14 students

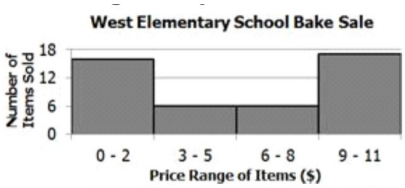
5

Topic: ***Collect***, ***organize***, *and* ***represent*** *data in a histogram.*

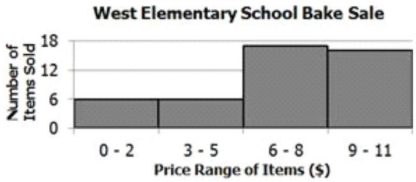
1. Molly kept a record of which goods were sold at the school bake sale. Which histogram represents the data correctly?

Item	Price ($)	Number Sold
Cookie	$1.00	4
Brownie	$3.00	6
Water	$1.00	7
Soda	$2.00	3
Candy Bar	$2.00	2
Pies	$9.00	8
Cakes	$11.00	9
Bread	$6.50	6

A

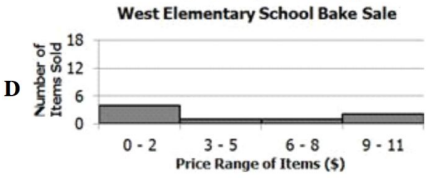


B

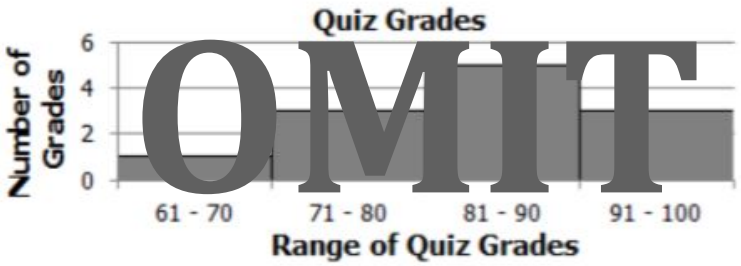


C

D



2. Look at the histogram.



The histogram represents which set of grades?

A {78, 84, 82, 82, 81, 95, 98, 89, 81, 68, 79, 88}

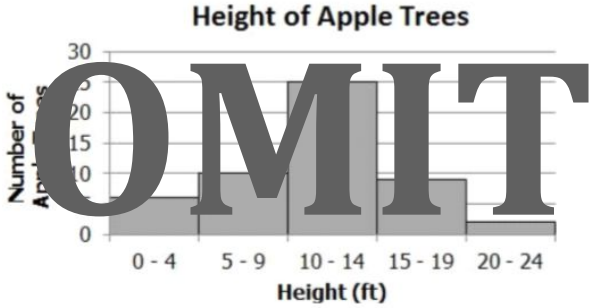
B {78, 84, 82, 79, 81, 95, 76, 89, 81, 72, 79, 96}

C {78, 84, 82, 79, 81, 95, 98, 89, 81, 68, 79, 96}

D {78, 84, 82, 64, 81, 95, 98, 89, 81, 68, 79, 96}

Topic: ***Make observations and inferences*** *about data represented in a histogram.*

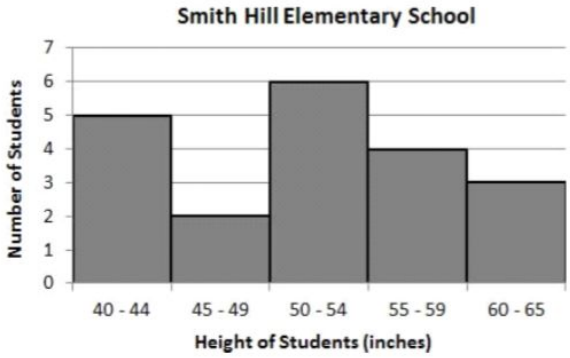
3. Randy measured the height of several apple trees and recorded his findings in the graph.



If Kim were going to grow an apple tree of her own, she could predict her apple tree will reach a height of --

A 12ft	B 3ft	C 19ft	D 21ft

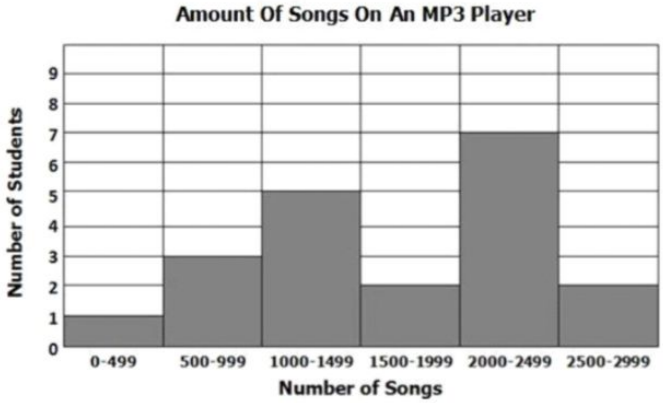
4. Look at the graph.



How many students were between 50 and 54 inches tall?

A 2	B 6	C 5	D 4

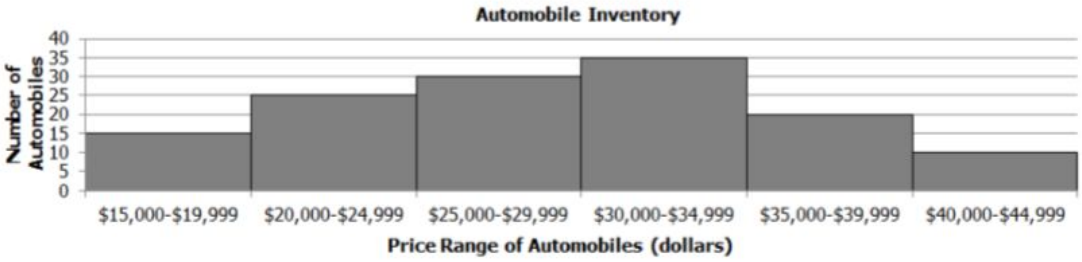
5. Look at the graph.



How many students have 1500 or more songs on their MP3 players?

A 9	B 2	C 11	D 20

6.



According to the histogram, how many more automobiles cost $35,000 or more than automobiles that cost less than $20,000?

A 20	B 45	C 15	D 30

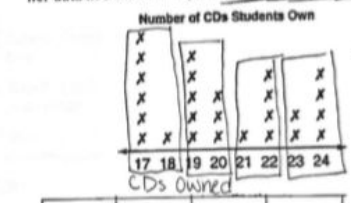
Topic: ***Compare*** *data represented in histograms with the same data represented in line plots, circle graphs, and stem-and-leaf plots.*

NOTES:

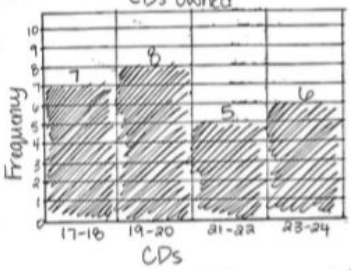
Comparing Histograms & Line Plots

Use the data below to create a histogram:

Susan asked students in her grade how many CDs they own. She displayed her data in a below line plot. Each *x* stands for 1 CD.



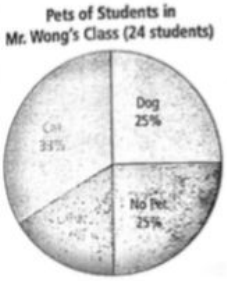
Intervals	Freq.
17-18	7
19-20	8
21-22	5
23-24	6



1. How many students did Susan survey? 7+8+5+6 = 26 students
2. Which interval has the least amount of CDs? 21-22
3. How many students had 21 – 24 CDs? 5+6 = 11 students

6

Comparing Histograms & Circle Graphs

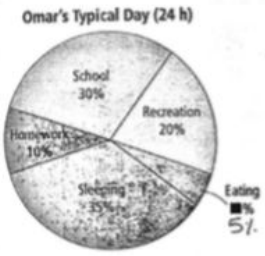


Cat = 8 (33%) No Pet = 6

$\frac{33}{100} \cdot 24$ $\frac{25}{100} \cdot 24 =$

Other = 4 Dog = 6

$\frac{17}{100} \cdot 24$ $\frac{25}{100} \cdot 24$



School = 7 $\frac{30}{100} \cdot 24$

Sleeping = 8 $\frac{35}{100} \cdot 24$

Eating = 1 $\frac{5}{100} \cdot 24$

Recreation = 5 $\frac{20}{100} \cdot 24$

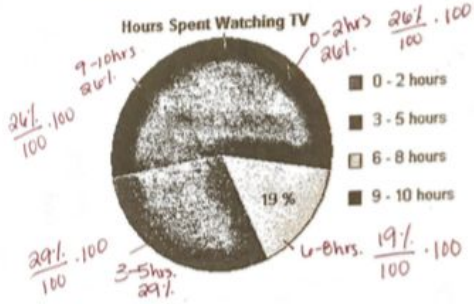
Homework = 2 $\frac{10}{100} \cdot 24$

7

Comparing a Histogram & Circle Graph

Use the data below to create a histogram:

Professor Williams asked 100 students in his class, "How many hours did you watch TV yesterday?" The pie chart displays his findings.



0-2 hrs $\frac{26}{100} \cdot 100 = 26$

9-10 hrs 26%

$\frac{26}{100} \cdot 100$

$\frac{29}{100} \cdot 100$

3-5 hrs 29%

6-8 hrs. $\frac{19}{100} \cdot 100$

Int.	Freq.
0-2	26
3-5	29
6-8	19
9-10	26

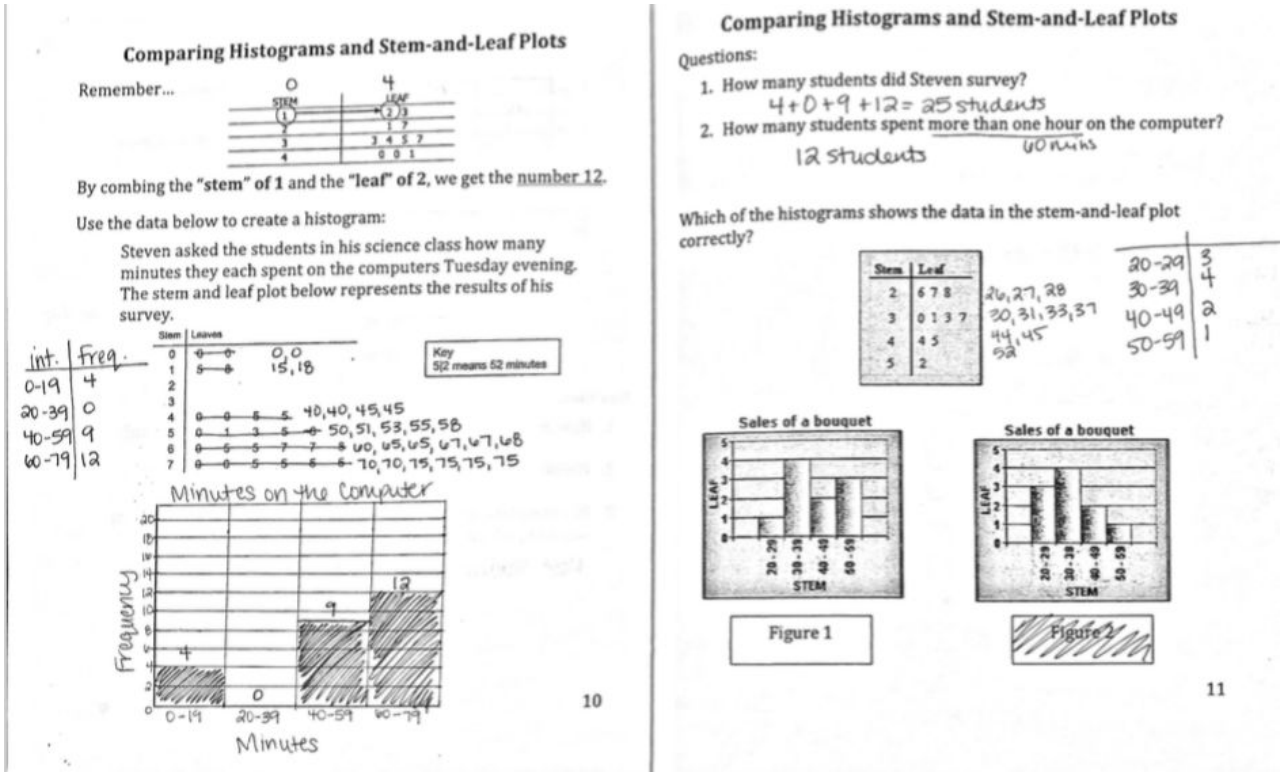
8

Comparing a Histogram & Circle Graph

Questions:

1. How many students watched more than 5 hours of television?
   19 + 26 = 45 students
2. Which interval had the most students watching television?
   3-5 hrs
3. In a complete sentence, what can you concluded about students watching television, based on the pie chart and histogram?
   Most students watch tv 0-5 hrs a day.

9



Comparing Histograms and Stem-and-Leaf Plots

Remember...

STEM	LEAF
0	4
1	2 3
2	1 7
3	3 4 5 7
4	0 0 1

By combing the **"stem" of 1** and the **"leaf" of 2**, we get the number 12.

Use the data below to create a histogram:

Steven asked the students in his science class how many minutes they each spent on the computers Tuesday evening. The stem and leaf plot below represents the results of his survey.

Stem	Leaves
0	0 0
1	5 8
2	
3	
4	0 0 5 5
5	0 1 3 5 6
6	0 5 5 7 7 8
7	0 0 5 5 5 6

Key: 5|2 means 52 minutes

0,0
15,18
40,40,45,45
50,51,53,55,58
60,65,65,67,67,68
70,70,75,75,75,75

Int.	Freq.
0-19	4
20-39	0
40-59	9
60-79	12

10

Comparing Histograms and Stem-and-Leaf Plots

Questions:

1. How many students did Steven survey?
   4+0+9+12 = 25 students
2. How many students spent more than one hour on the computer?
   12 students (60 mins)

Which of the histograms shows the data in the stem-and-leaf plot correctly?

Stem	Leaf
2	6 7 8
3	0 1 3 7
4	4 5
5	2

26,27,28
30,31,33,37
44,45
52

20-29	3
30-39	4
40-49	2
50-59	1

Figure 1

Figure 2

11

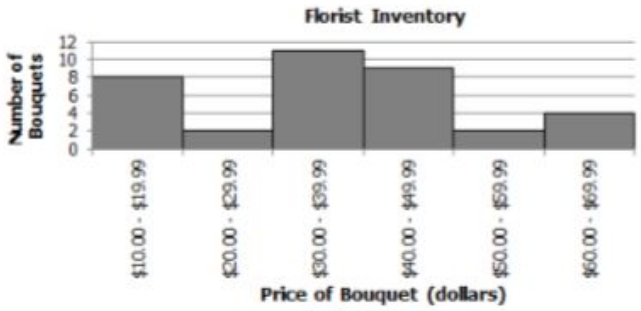
7. A florist recorded the number and cost of flower bouquets that were sold daily and recorded the data below.

Florist Inventory

Cost of Bouquet	Tally
$10.00 - $19.99	𝍸 III
$20.00 - $29.99	III
$30.00 - $39.99	𝍸 𝍸 I
$40.00 - $49.99	II
$50.00 - $59.99	𝍸 IIII
$60.00 - $69.99	IIII

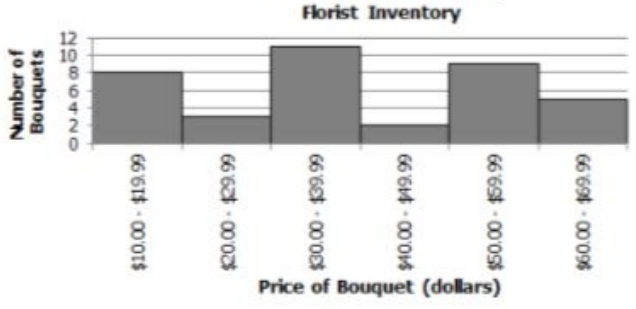
Which histogram represents the same data?

A

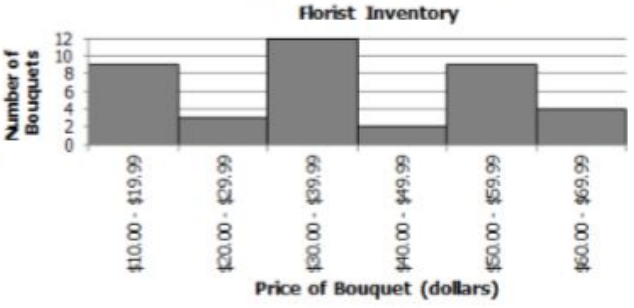


C

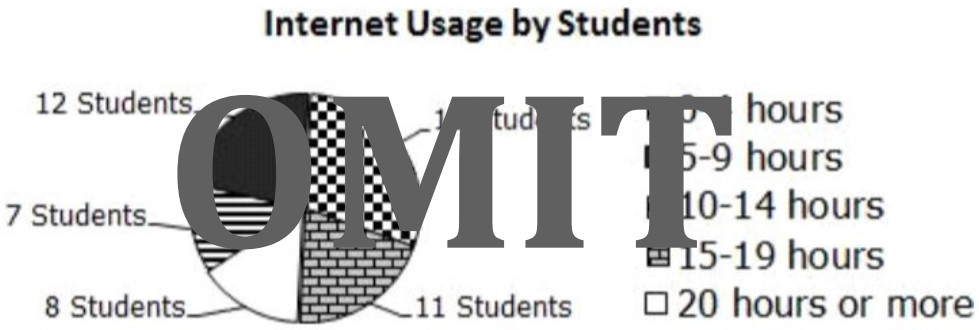
B



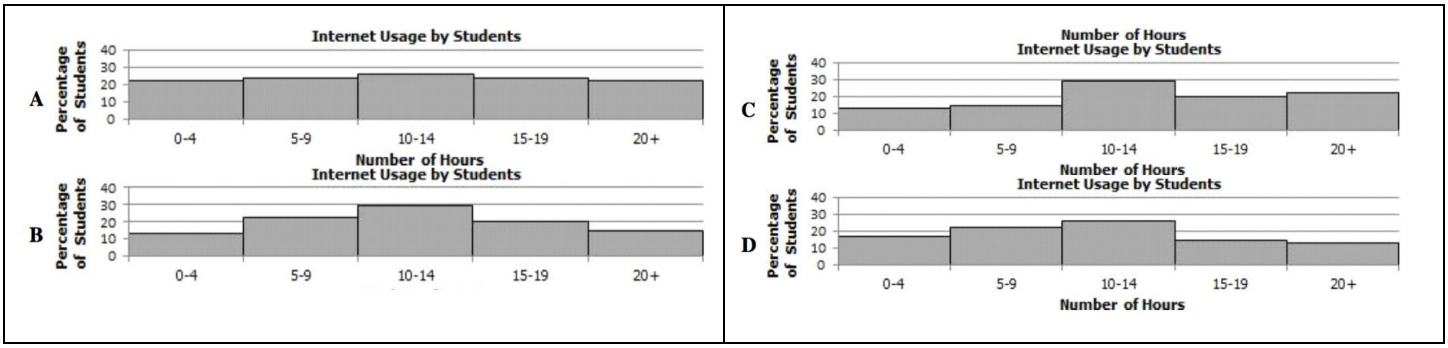
D



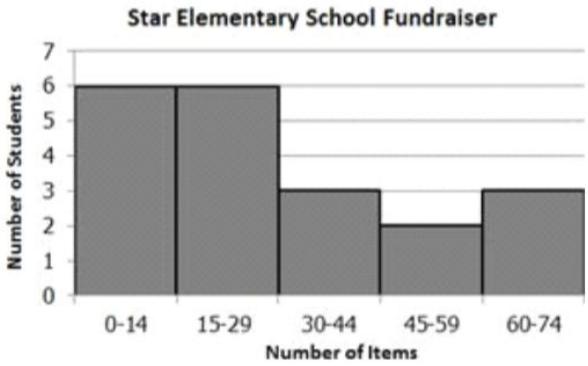
8. Students were asked how many hours per week they used the internet. The data is shown in the circle graph.



Which graph represents the same data?



9. The amount of items that each student sold for the class fundraiser was recorded. Which stem-and-leaf plot represents the same data represented in the histogram?



A

Stem	Leaf
0	4 4 5 6 7
1	0 2 2 5 5 7
2	2 2 8
3	6
4	2 4 5 7 7
5	
6	8 8

Key: 2|2 = 22

B

Stem	Leaf
0	4 4 5 6 7
1	0 2 2 5 5 7
2	2 2 8
3	6 6 6
4	2 4 5
5	5
6	8 8

Key: 2|2 = 22

C

Stem	Leaf
0	4 4 5
1	0 2 2 5 5 7
2	2 2 8
3	6
4	2 4 5
5	5
6	8 8 9

Key: 2|2 = 22

D

Stem	Leaf
0	4 4 5 6 7
1	0 2 2 5 5 7
2	2 2 8
3	6
4	2 4 5
5	5
6	8

Key: 2|2 = 22