

## Welcome back MYP 9 Math!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
<b>Monday</b> Date: <u>4-23</u> Topic: <u>Friday was Quiz 7.1</u>	0 1 2	
<b>Tuesday</b> Date: _____ Topic: _____	0 1 2	
<b>Wednesday</b> Date: _____ Topic: _____	0 1 2	
<b>Thursday</b> Date: _____ Topic: _____	0 1 2	
<b>Friday</b> Date: _____ Topic: _____	0 1 2	

## Class Plan

1. Warm-up

2. Mathematician Monday

2. Comparing Multiple Data Sets

A

Chapter 17

**COMPARING THE MEASURES  
OF CENTRE AND SPREAD**

3. Practice

Analysing a single set of data can be useful, but sometimes to fully understand a situation we need to compare two data sets. We can do this by comparing statistics such as measures of **centre** and **spread**, and also **graphically**.

## Chapter

# 17

## Comparing numerical data

- Contents:**
- A** Comparing the measures of centre and spread
  - B** Comparing data sets graphically
  - C** Parallel box-and-whisker plots

Introduction to Chapter 17: *What do you notice about Minneapolis Precipitation?*  
*How should we compare data on rain?*

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.90	0.74	0.69	4.09	5.93	3.73	3.68	6.85	1.28	5.25	0.36	0.36
0.31	1.03	1.99	3.55	2.22	3.90	4.86	9.05	5.92	3.45	2.79	2.79
0.32	0.31	0.71	2.29	4.19	4.64	7.60	3.20	4.02	2.74	4.34	4.34
1.28	1.36	0.72	6.44	4.05	11.47	2.74	2.75	2.22	1.44	0.92	0.92
0.83	1.23	2.01	4.71	5.88	6.13	4.46	1.99	1.33	3.63	0.56	0.56
0.47	1.88	1.47	3.05	9.34	3.92	4.24	1.62	0.37	1.26	0.80	0.80
1.00	1.11	2.28	3.05	4.76	4.78	5.56	3.35	0.45	0.89	0.23	0.23
0.57	0.80	0.88	2.49	2.64	5.94	3.99	5.91	5.66	1.92	2.01	2.01
0.53	1.09	1.61	1.43	0.44	3.24	1.36	7.20	0.59	5.77	0.49	0.49
0.15	0.49	2.18	3.54	2.36	3.18	2.67	2.97	2.14	1.78	1.27	1.27
0.80	1.44	3.66	1.80	2.67	2.02	2.52	7.85	5.79	4.75	0.10	0.10
0.81	0.36	1.74	3.81	2.80	3.27	1.83	6.82	3.31	0.58	1.01	1.01
1.26	1.04	1.27	2.63	3.33	5.00	2.93	4.38	6.28	5.26	1.65	1.65
0.45	1.40	2.28	2.61	5.61	4.15	3.51	1.78	4.34	3.02	1.10	1.10
0.31	1.02	1.64	2.52	6.32	5.96	2.08	0.77	2.00	0.82	1.03	1.03
0.48	0.52	1.80	3.50	3.24	8.49	5.43	7.07	4.20	4.17	0.09	0.09
1.16	1.18	1.04	7.10	5.23	5.78	2.06	2.56	3.90	1.05	3.15	3.15
0.86	1.05	1.15	1.16	4.43	3.79	6.20	3.48	2.48	1.07	3.57	3.57
1.29	0.30	1.57	3.37	6.21	4.93	5.05	3.24	2.67	0.70	0.82	0.82
1.20	0.74	3.78	1.64	4.22	4.90	2.70	5.63	1.21	2.42	1.38	1.38

**Warm-up:** Who's the better soccer player?  
(Goals in 5 games)

Player A: {0, 0, 0, 3, 3}

Player A: {1, 1, 1, 2, 1}



## OPENING PROBLEM

At the local soft drink factory, there are two machines which place screw caps on the plastic bottles. The quality control officer Hugh suspects that machine A causes fewer faulty screw caps than machine B. Each day 1000 bottles are randomly selected from the machines, and their caps are tested for faults. Hugh records the number of faulty caps each day for 50 days.



The results are:

### Machine A

4	7	5	6	6	5	6	6	7	6	6	5	5	8	6	6	5	7	4	8	9	6	7	5	6
6	8	6	5	9	6	8	7	5	6	6	4	6	5	5	7	5	6	4	6	5	6	6	5	6

### Machine B

5	9	9	7	3	9	8	10	8	6	7	7	9	8	5	9	9	4	11	9	6	9	7	9	8
9	7	9	8	8	9	4	10	8	6	9	7	3	8	7	5	9	8	7	6	8	4	9	10	9

### Things to think about:

- Can you clearly state the problem that the quality controller Hugh wants to solve?
- How has Hugh tried to make a fair comparison?
- How can we display these data sets in a way that makes them easy to compare?
- How can Hugh best indicate the most typical number of faulty caps for each machine?
- How can Hugh indicate the spread of the data for each machine?
- Can Hugh make a satisfactory conclusion?

# A

## COMPARING THE MEASURES OF CENTRE AND SPREAD

Analysing a single set of data can be useful, but sometimes to fully understand a situation we need to compare two data sets. We can do this by comparing statistics such as measures of **centre** and **spread**, and also **graphically**.

To compare the statistics of two data sets, we use:

- the **mean** or **median** of each data set to compare their centres
- the **range** or **interquartile range** of each data set to compare their spreads.

## Mathematician Monday





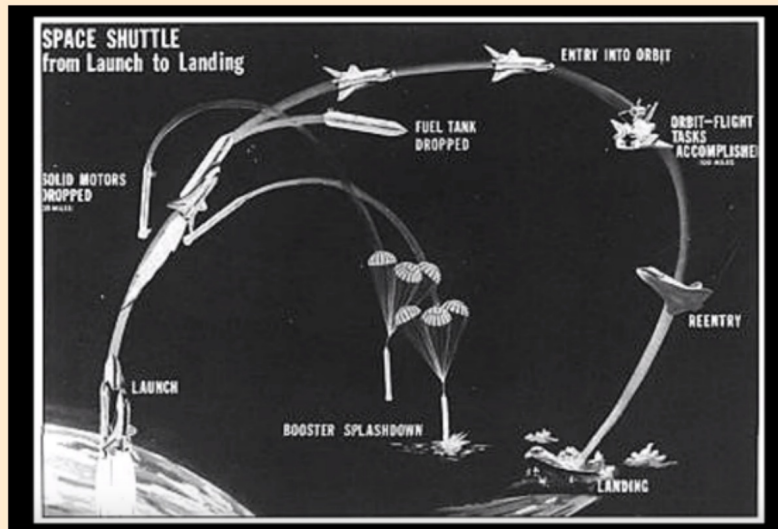
## Mathematician Monday



<https://www.youtube.com/watch?v=y8VDQj2TUUk>

# Mathematician Monday

Katherine Johnson Legacy



<https://www.youtube.com/watch?v=8g3AvxrVTic>

## Mathematician Monday

Katherine Johnson Interview, Sept. 2017

What's going through your mind knowing that NASA's opening a new 37,000 square foot facility in your honor?

What advice do you have for the young engineers that will be working in this facility at NASA?

<https://www.youtube.com/watch?v=FgW2kpNQ7BY>

**Example 1**

Julie and Andrea both play goalshooter for their respective netball teams.

Julie played 11 games and scored 15, 19, 22, 20, 24, 19, 21, 23, 25, 16, and 23 goals.

Andrea played 10 games and scored 16, 10, 21, 14, 24, 8, 11, 13, 17, and 20 goals.

- a Find the mean number of goals scored for each player.
- b Which player scored the higher number of goals per game?
- c Find the range of scores for each player.
- d Which player had the greater spread of scores?



**a** Julie's mean =  $\frac{15 + 19 + 22 + 20 + 24 + 19 + 21 + 23 + 25 + 16 + 23}{11}$   
=  $\frac{227}{11}$   
 $\approx 20.6$  goals

Andrea's mean =  $\frac{16 + 10 + 21 + 14 + 24 + 8 + 11 + 13 + 17 + 20}{10}$   
=  $\frac{154}{10}$   
= 15.4 goals

- b** On average, Julie scored the higher number of goals per game.
- c** Julie's range =  $25 - 15 = 10$  goals  
Andrea's range =  $24 - 8 = 16$  goals
- d** Andrea had the greater spread of scores.

# Netball...

**Netball** is a ball sport played by two teams of seven players. Its development, derived from early versions of basketball, began in England in the 1890s. By 1960, international playing rules had been standardised for the game, and the International Federation of Netball and Women's Basketball (later renamed the [International Netball Federation \(INF\)](#)) was formed. As of 2011, the INF comprises more than 60 national teams organized into five global regions.

Games are played on a rectangular court with raised goal rings at each end. Each team attempts to score goals by passing a ball down the court and shooting it through its goal ring. Players are assigned specific positions, which define their roles within the team and restrict their movement to certain areas of the court. During general play, a player with the ball can hold on to it for only three seconds before shooting for a goal or passing to another player. The winning team is the one that scores the most goals. Netball games are 60 minutes long. Variations have been developed to increase the game's pace and appeal to a wider audience.

<https://en.wikipedia.org/wiki/Netball>



Malawi (red) playing Fiji (blue) at the 2006 Commonwealth Games

<b>Highest governing body</b>	International Netball Federation
<b>Registered players</b>	561,000+ <sup>as of 11</sup>

Characteristics	
<b>Contact</b>	Limited
<b>Team members</b>	Seven on-court players per team
<b>Mixed gender</b>	Yes, separate competitions and mixed gender teams
<b>Type</b>	Team sport, ball sport
<b>Equipment</b>	Netball, bib
<b>Venue</b>	Netball court

## Example: Compare Netballers

Both players play goalshooter for their respective netball teams.

Player A played 10 games and scored 15, 19, 22, 20, 24, 19, 21, 23, 25, 16, and 23

Player B played 10 games and scored 16, 10, 21, 14, 24, 8, 11, 13, 17, and 20 goals

1. Find the mean for each player, who has a better average?

2. Find the range, IQR (do 5 # summary...), and standard deviation of each player. Who's data is more spread?

3. Defend who you think is a better player. What are your limitations in this conclusion?



**A****COMPARING THE MEASURES OF CENTRE AND SPREAD**

*Andrea and Julie both play goal shooter for their respective Netball teams.*

1) Enter both data sets into your graphing calculator:  $L_1$ : Julie's goals,  $L_2$ : Andrea's goals

Julie played 11 games and scored 15, 19, 22, 20, 24, 19, 21, 23, 25, 16, and 23 goals.

Andrea played 10 games and scored 16, 10, 21, 14, 24, 8, 11, 13, 17, and 20 goals.

a) Find the mean number of goals scored for each player.

Julie:  $\bar{x} \approx \underline{20.6}$  goals

Andrea:  $\bar{x} = \underline{15.4}$  goals

b) Which player scored the higher number of goals per game? Defend your answer.

On average, Julie scored the higher number of goals per game because her mean was 20.6 goals. This is more than 5 goals more per game than Andrea!



**A****COMPARING THE MEASURES OF CENTRE AND SPREAD**

c) i) Find the 5-number summary, range, IQR, and standard deviation of their scores.

**Julie:** Min 15  $Q_1$  19 Median 21  $Q_3$  23 Max 25

Range 10 IQR 4  $\sigma \approx$  3.1

**Andrea:** Min 8  $Q_1$  11 Median 15  $Q_3$  20 Max 24

Range 16 IQR 9  $\sigma \approx$  4.9

d) Which player had the greater spread of scores? Justify answer using measures of spread.

\*Andrea has the greater spread of data, because her range is 6 more goals than Julie.

\*9 goals has a wider spread of 50% of the data than Julie with 4 goals. IQR

\*On average, Andrea is about 5 goals away from her 15.4 average, compared to Julie with about 3 goals.

A

## COMPARING THE MEASURES OF CENTRE AND SPREAD

e) Who is the better netball goalshooter? Justify answer using measures of spread.

^Center &

Julie is the best goalshooter because...

- 1) Julie has the best average, so she scores more goals per game than Andrea.
- 2) Julie has the highest number of goals scored, 25 compared to Andrea's 24.
- 3) Julie is also a more consistent player since her number of goals are less spread out than Andrea.  
-Julie would be a more reliable player to have on the team! :)

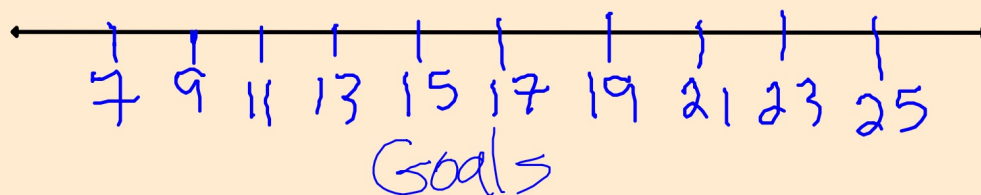
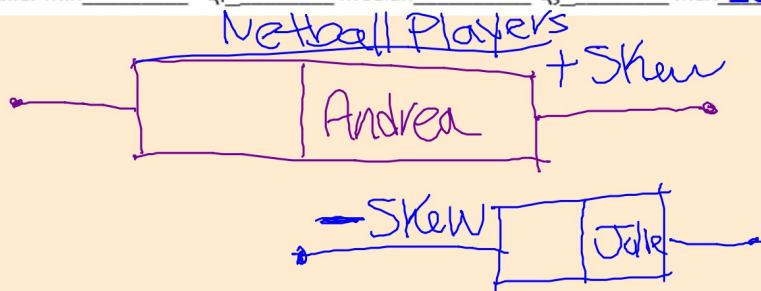
## Limitations

- 1) There are other measures, other than points, that contribute to determining whether a netballer is a good player. Scoring isn't everything!  
(Assists/rebounds/steals/turnovers)
- 2) This is a small sample of games (only 11 and 10 games)
- 3) Andrea has played one less game than Julie

## Create parallel box plot to show centers and spread

Andrea: Min 8     $Q_1$  11    Median 15     $Q_3$  20    Max 24

Julie: Min 15     $Q_1$  19    Median 21     $Q_3$  23    Max 25



(Tomorrow - comparing data displays...)

# Exercises... #1-4

## 17A Compare Center/Spread

### EXERCISE 17A

1 A local council counted the number of cars which drove along Park Street and High Street each day over a number of months. The measures of centre and spread for the data are shown in the table alongside.

- a Which street is used by more cars per day?
- b Which street has the greater spread in the number of cars that use it each day?

	<i>Park Street</i>	<i>High Street</i>
Mean	543	619
Median	562	603
Range	120	93
IQR	55	44

## Exercises... 17A Compare Center/Spread

- 2 The points scored by two basketball teams over a 12 match series are:
- Team A: 91, 76, 104, 88, 73, 55, 121, 98, 102, 91, 114, 82
- Team B: 87, 104, 112, 82, 64, 48, 99, 119, 112, 77, 89, 108
- Which team had the higher mean score?

## Exercises... 17A Compare Center/Spread

- ▮ A school in Toronto has two Year 9 classes. The data below shows the number of days the students in each class were away sick during the school year.

Class 9A						Class 9B					
0	5	3	4	0	13	8	5	9	0	2	6
3	6	7	2	3	1	4	7	12	8	3	9
5	5	9	11	4	9	10	17	9	2	0	13
0	6	4	0	8		21	8	14	11	6	3

- How many students from each class did not have any sick days?
- Calculate the median of each data set.
- Calculate the interquartile range of each data set.
- In which class did the students on average take more sick days?
- In which class was there a greater spread in the number of sick days?



## Exercises... 17A Compare Center/Spread

The chess points ratings for members of two chess clubs are given below:

**The Rookies:** 1176 1208 1322 1105 1098 1301 1111 1225 1076  
1099 1233 1176 1153 1258 1358 1236 1083 1184

**Best Mates:** 1208 1053 1133 1181 1313 1214 1102 1107 1057  
1157 1410 1030 972 1095 1020 1046 1152 1216

- Calculate the mean and median rating for the members of each club.
- Calculate the range and interquartile range for each club.
- Which club generally has the higher rated players?
- Which club has the greater spread in player ratings?





### EXERCISE 17A

- 1** **a** High Street      **b** Park Street
- 2** Team B (Team A:  $\approx 91.3$ , Team B:  $\approx 91.8$ )
- 3** **a** Class 9A: 4 students; Class 9B: 2 students  
**b** Class 9A: 4 sick days; Class 9B: 8 sick days  
**c** Class 9A: 5 sick days; Class 9B: 7 sick days  
**d** Class 9B      **e** Class 9B
- 4** **a** The Rookies: mean = 1189 points, median = 1180 points;  
Best Mates: mean = 1137 points, median = 1120 points  
**b** The Rookies: range = 282 points, IQR = 131 points;  
Best Mates: range = 438 points, IQR = 155 points  
**c** The Rookies (mean and median values are higher)  
**d** Best Mates (range and IQR are higher)