

Statistics Project

In track and field, there are three shot put throwers who are battling it out to make the cuts to go to IASAS. With IASAS coming closer, Mr. Santowski is facing the challenge of having to choose only one of these three throwers to go. In order to help him decide who is the best thrower, he has asked two **math** experts to create a statistical analysis on the distances of each thrower's throws

Part 1: Statistical Analysis

These are a set of data tables that show the process from acquiring the raw data to finding the mean, median and modes for each thrower's distances, as well as visual representations with frequency histograms and box plots to aid the coach as he makes his decision. By organizing this data, it becomes more clear who is the best performer.

Distances Each Thrower Threw in Meters

Thrower #1
8.43
8.69
8.74
8.79
8.85
8.94
8.95
9.04
9.25
9.26
9.30
9.39
9.46
9.65
9.66
9.78
10.01
10.01
10.14
10.23
10.25
10.62

Thrower #2
8.03
8.25
8.76
8.85
8.95
8.96
8.96
9.00
9.10
9.15
9.25
9.35
9.35
9.53
9.68
9.98
10.10
10.20
10.39
10.82
10.86
10.94

Thrower #3
8.49
8.79
8.82
8.83
8.96
9.12
9.13
9.24
9.25
9.38
9.39
9.49
9.56
9.62
9.63
9.72
9.75
9.83
9.94
9.94
9.98
11.47

After being given the raw data, the means, medians and modes were calculated to help present the averages of each thrower's throws in total. The way that the table is displayed also makes it easier to compare their figures and see who has managed to throw the farthest on average.

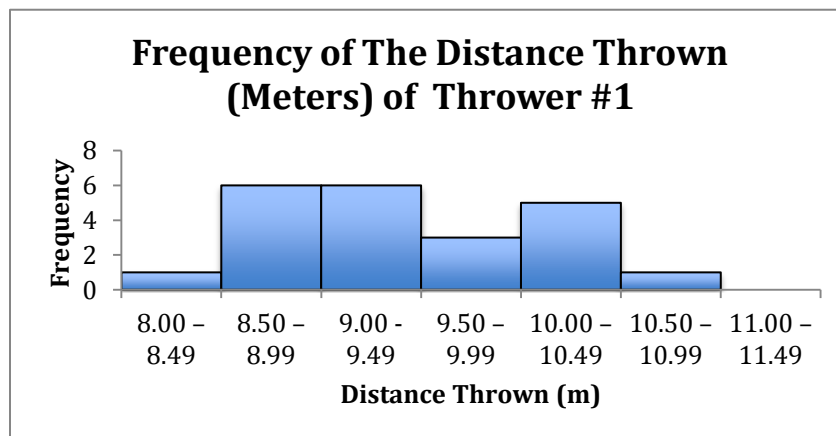
Table Showing The Mean, Median, and Mode for Each Distance In Meters Each Thrower Threw

Calculations	Distance (m)		
	Thrower #1	Thrower #2	Thrower #3
Mean	9.43	9.48	9.47
Median	9.35	9.30	9.44
Mode	10.01	9.35	9.94

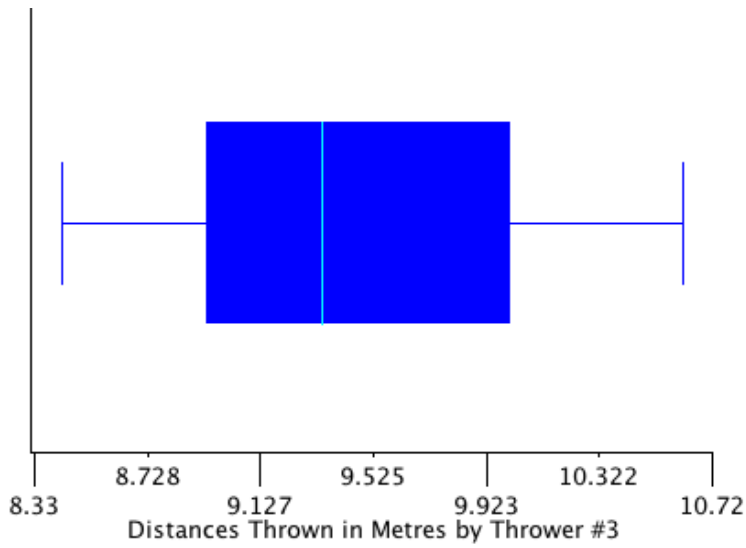
The Frequency For Each Distance Every Thrower Can Throw In Meters

Distance Thrown (Meters)	Frequency		
	Thrower #1	Thrower #2	Thrower #3
8.00 – 8.49	1	2	1
8.50 – 8.99	6	5	4
9.00 - 9.49	6	6	7
9.50 – 9.99	3	3	9
10.00 – 10.49	5	3	-
10.50 – 10.99	1	3	-
11.00 – 11.49	-	-	1

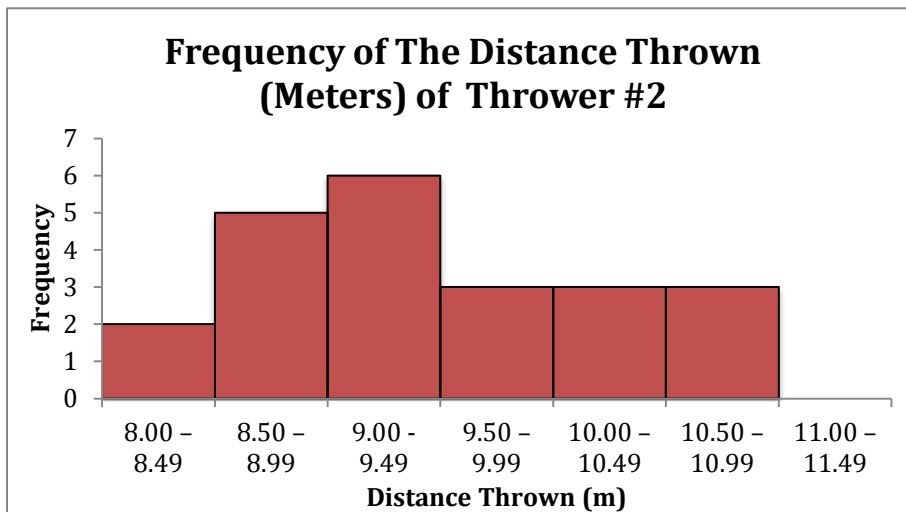
Below are pairings of each thrower's frequency histogram and box plot including the five number summaries. These visual representations of the acquired data help make it more clear how many times each thrower has thrown a particular distance in order to predict what he will most likely throw in IASAS, and display the distribution of their throws. As for the five number summaries, they display the maximum distance each thrower threw, the minimum distance, the median and the medians of the first and third quartiles. These numbers provide a concise summary of the distribution of the observations, and make it easier to compare the three sets of observations by comparing them specifically.



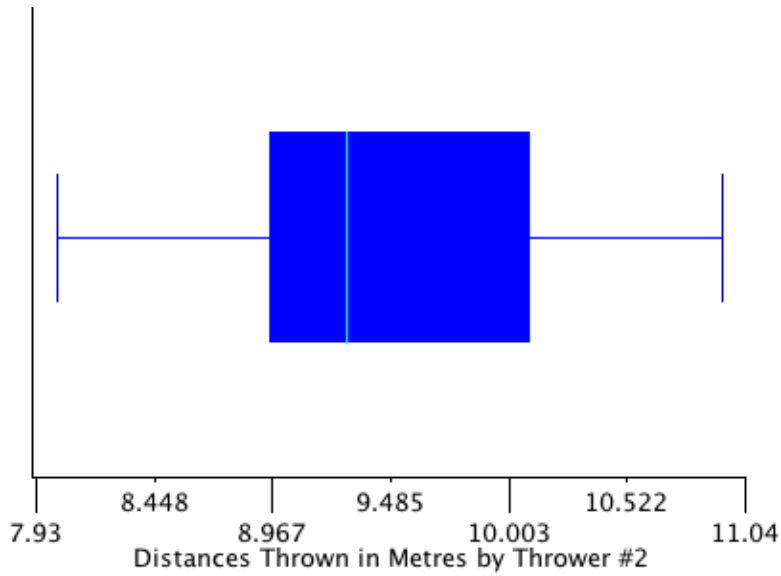
Box and Whiskers Plot for the Distances Thrown by Thrower #1



Min = 8.43
Max = 10.62
Q1 = 8.94
Q2 (Median) = 9.35
Q3 = 10.01



Box and Whiskers Plot for the Distances Thrown by Thrower #2



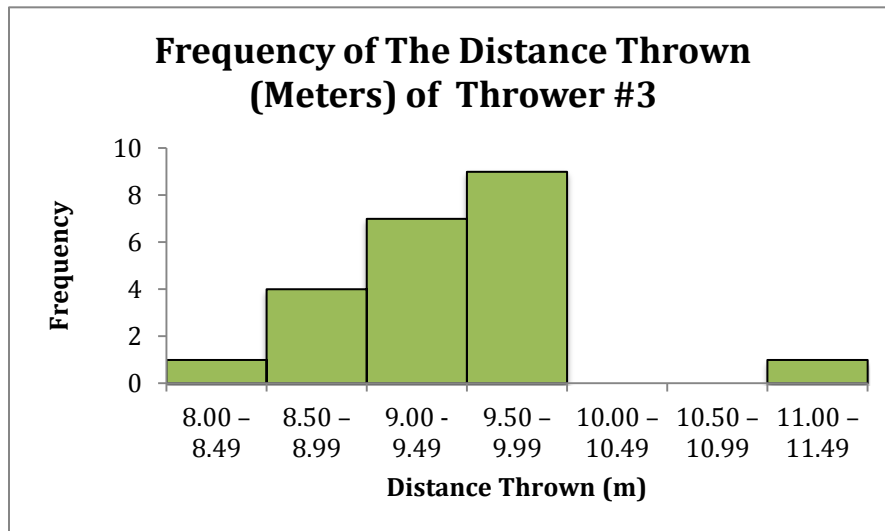
Min = 8.03

Max = 10.94

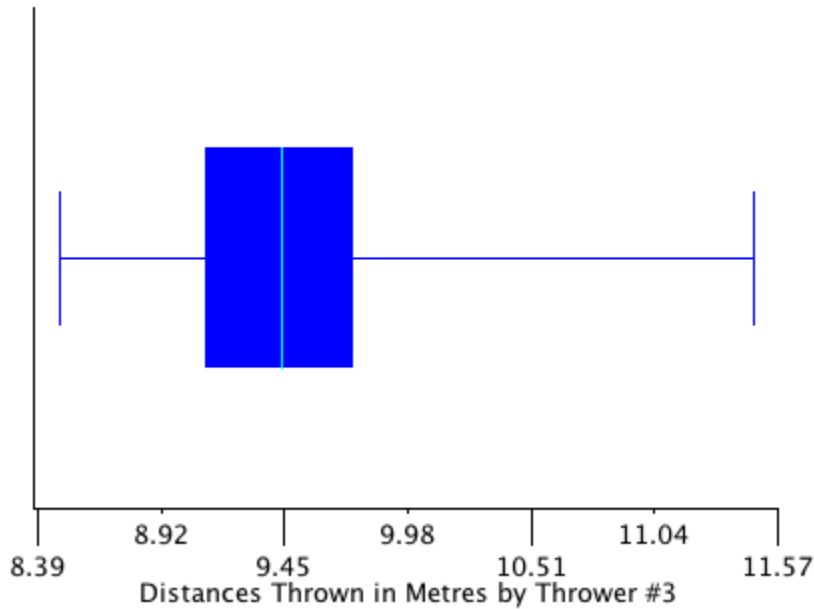
Q1 = 8.96

Q2 (Median) = 9.3

Q3 = 10.1

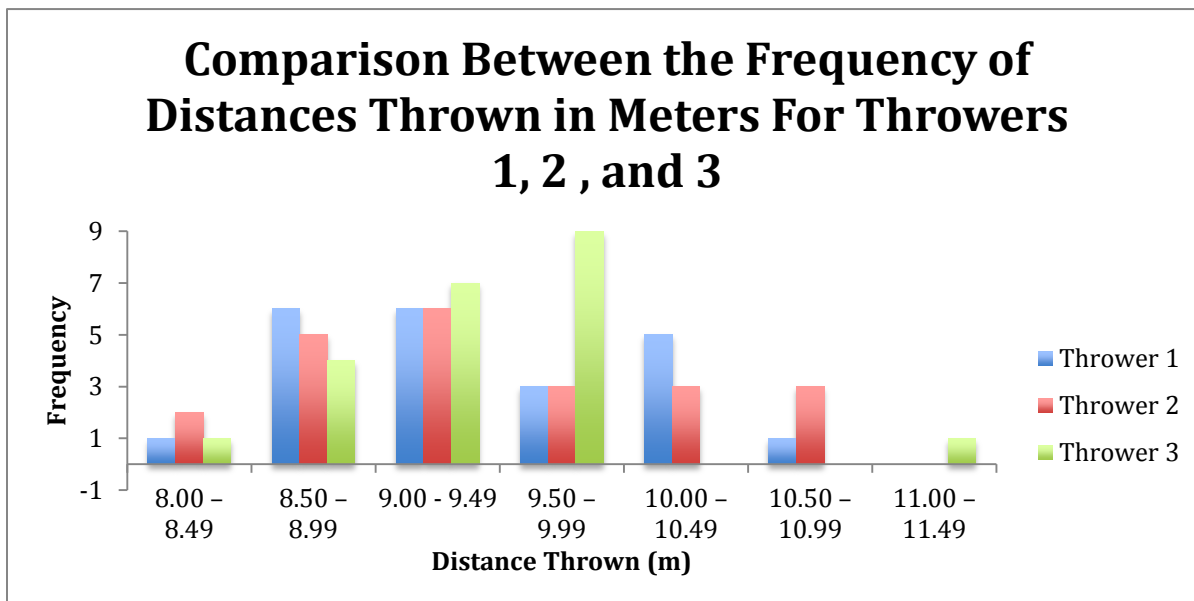


Box and Whiskers Plot for the Distances Thrown by Thrower #3



Min = 8.49
 Max = 11.47
 Q1 = 9.12
 Q2 (Median) = 9.44
 Q3 = 9.44

The table below is a frequency histogram comparing all of the throwers' data in their previous histograms to give a better visual representation of the ability of each thrower compared to their opponents.



Part 2: Decision Making and Justifying

What it means to be the best thrower:

In order to determine who in fact is the best thrower, they must have three characteristics: have a general consistency in their distances, throw long distances, and attain a high mean because with this set of continuous data, the mean is the best way to find the average length of each throwers' throws.

Who is the best thrower?

After analyzing the data, it has been decided that Thrower #2 is the best thrower because he is the most consistent in his longer throws, so there is a higher probability of him doing well in IASAS. If you study his frequency graph, he has thrown in the range 9.50 – 10.99 metres nine times in total. If compared to Thrower #3, you can see that he is very inconsistent in his higher throws, and the only reason that his box plot is longer is because of his 11.00 – 11.49 metres anomaly which is not a good indication of his throwing ability. Thrower #1 is also inconsistent, with most of his throws being in the 8.50 – 9.49 metres range.

Overall, Thrower #2's distances are also quite long on their own, with his mean being 9.48 metres – the highest out of the three throwers. The mean is a good way to measure each thrower's ability in this case because it works best with continuous data. Although the median and modes can also be indicators, they work best with quantitative and nominal data.

PART 4: Revising Decisions

These are new tables showing the raw data as well as the means, medians and modes for the distances that each thrower throws during weeks 2, 4, 6, 8 and 10. This newly found information will give the coach a better insight as to how each thrower has progressed during the season and when they will most likely reach their full potential.

Table Showing the Raw Data from the Training Weeks (m)

Training Week #	Thrower #1	Thrower #2	Thrower #3
Week 2	8.43, 8.74, 8.69, 8.79, 8.85	10.39, 10.86, 10.94, 9.00, 9.15	8.79, 9.39, 9.94, 8.83, 9.72
Week 4	8.94, 9.04, 9.26, 8.95	9.35, 9.35, 8.25, 8.85	8.49, 9.63, 9.49, 9.83
Week 6	9.25, 9.39, 9.30, 9.66	8.95, 9.10, 10.20, 9.53	8.82, 9.24, 9.13, 9.56
Week 8	10.01, 9.65, 9.46, 10.01	8.76, 8.03, 8.96, 9.25	9.94, 9.75, 9.12, 8.96
Week 10	9.78, 10.14, 10.23, 10.62, 10.25	9.98, 10.82, 10.10, 8.96, 9.68	11.47, 9.25, 9.38, 9.62, 9.98

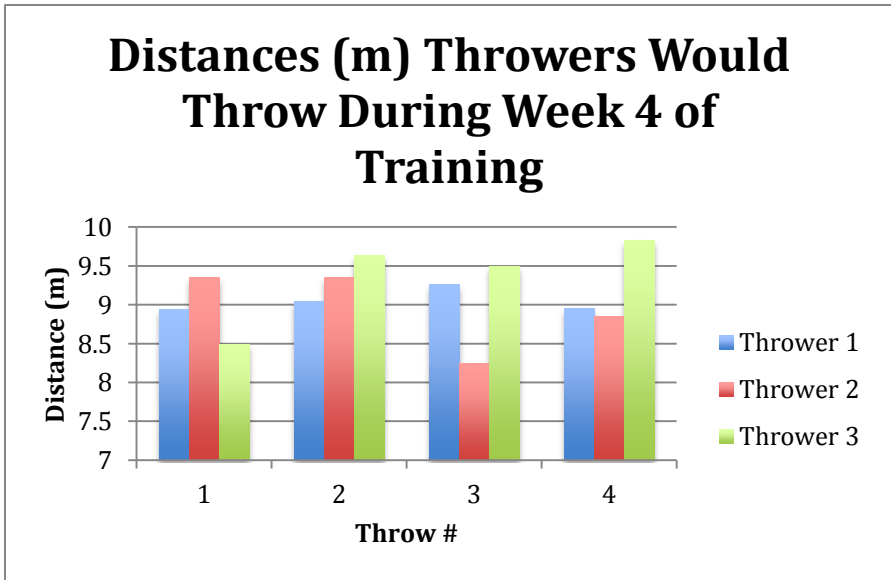
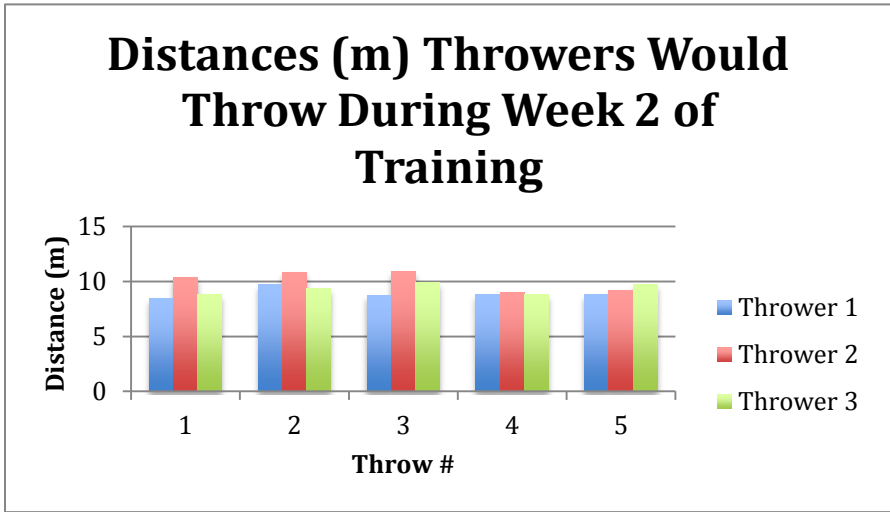
Calculations	Distance (Metres) Each Week for Thrower #1				
	Week 2	Week 4	Week 6	Week 8	Week 10
Mean	8.7	9.05	9.4	9.78	10.2
Median	8.74	8.99	9.35	9.83	10.2
Mode	-	-	-	10.01	-

Calculations	Distance (Metres) Each Week for Thrower #2				
	Week 2	Week 4	Week 6	Week 8	Week 10

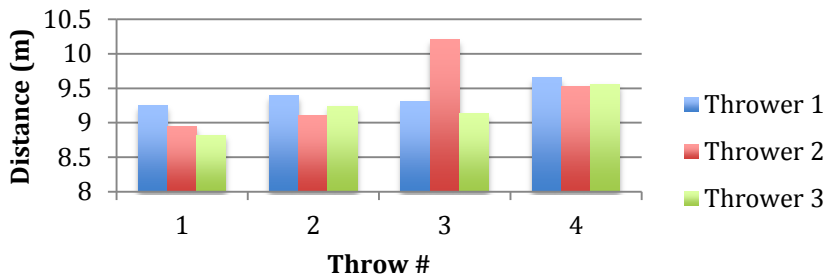
Mean	9.99	8.95	9.45	8.75	9.91
Median	10.0	9.1	9.32	8.86	9.98
Mode	-	9.35	-	-	-

Calculations	Distance (Metres) Each Week for Thrower #3				
	Week 2	Week 4	Week 6	Week 8	Week 10
Mean	9.33	9.36	9.19	9.44	9.94
Median	9.39	9.56	9.19	9.44	9.62
Mode	-	-	-	-	-

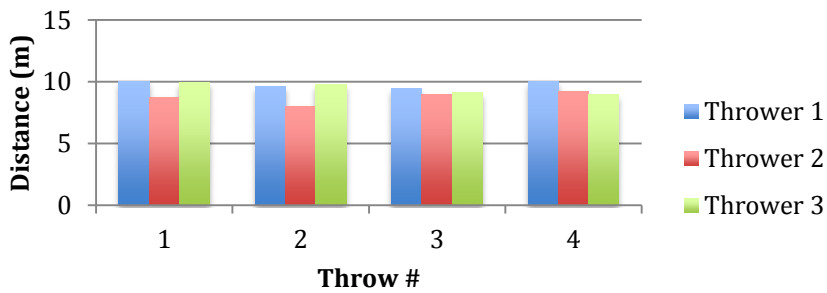
Below are graphs comparing all of the distances that each thrower threw during each training week. These can be used to help show how each thrower has progressed throughout the season as well as give the coach a better idea as to how far each thrower has thrown compared to the others.



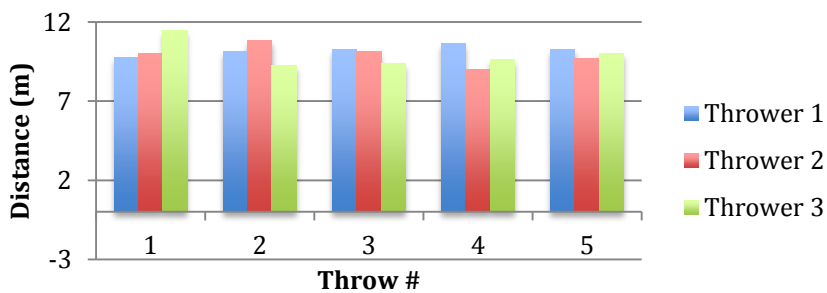
Distances (m) Throwers Would Throw During Week 6 of Training



Distances (m) Throwers Would Throw During Week 8 of Training



Distances (m) Throwers Would Throw During Week 10 of Training



After considering this new representation of the data first given us in Part 1, it has been decided that Thrower #1 is in fact the best thrower. Reasons for this include his great improvement from week 2 to week 10, the distances that he ended up throwing, as well as his consistency.

A good way to see how Thrower #1 improved week by week is in the table showing the Distance (Metres) Each Week for Thrower #1. By looking at the mean, it can be observed that each week he has improved by at least 0.35 metres. When comparing to our previous "best thrower" Thrower #2, the consistency in improving each week cannot be found in his table, as he constantly improves and then regresses from week to week. This consequently suggests that the thrower is inconsistent and therefore unreliable when IASAS rolls around. As for Thrower #3, he manages to show progression in his throws, yet not as much as Thrower #1.

To further justify why Thrower #1 should be taken instead of throwers #2 and #3, the graphs can be used to better compare their progression week to week. During week 2, thrower #2 seems to be dominating with three out of five of his throws being the farthest. However, in week 4 only one of his throws comes out on top, with Thrower #3 dominating and Thrower #1 not far behind. During week 6 is where you start to see Thrower #1's improvement in throwing capability, as he seems to be consistently improving with each throw, and managing to come out on top with three out of four of his throws. As for week 8, this is where Thrower #1 starts to really shine, managing to throw consistently and with good distances that prove his capability as a thrower. Lastly, during week 10 Thrower #2 and #3 manage to throw far distances, with Thrower #1 greatly improving in his fourth throw and maintaining his consistency throughout all five throws.

What's more, when looking at the raw data table organized into each training week, by week 10 Thrower #1 ends up throwing the farthest out of the three throwers. To add to consistency and improvement, a good thrower also has to be able to throw far. A good example of this is Thrower #3, who although manages to be quite consistent each week and showed signs of improvement only managed to throw 9's in his last week apart from his anomaly of 11.47 metres. As for Thrower #2, although he does manage to get in quite a lot of good throws, his consistency is questionable and can therefore not be relied upon.