*A problem-solving and modelling task suitable for students working with* ***Statistics (Focus: Data Interpretation)***

**Modelling Northern Qld**

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**QCAA approach to problem solving and mathematical modelling**

(<https://www.qcaa.qld.edu.au/downloads/portal/syllabuses/snr_maths_methods_19_syll.pdf>)

***SOLUTIONS***

**How important is height for the Townsville Fire players?**

Australian Curriculum Content Descriptors:

**Year 7**

Calculate *mean*, *median*, *mode* and *range* for the sets of data. Interpret these statistics in the context of data. [(ACMSP171)](http://www.scootle.edu.au/ec/search?accContentId=ACMSP171)

1. How important is the height of the Townsville Fire players when compared to other teams? Do you know if this highly successful team tends to be “taller” or “shorter” than other WNBL teams? Add your opinion here before you continue:

*Height is a significant factor with the Townsville Fire’s highly successful team as the taller players tend to dominate play during games.*

Research & Formulate

1. How would you go about figuring out if a team is “taller” or “shorter” than another team?

*Compare the average (mean) height of the players in both teams and also the maximum and minimum heights with the range in their heights.*

**Let’s start with some background info about the Townsville Fire and the heights of the current players.**

**The JCU Townsville Fire are a professional female basketball competing in the Australian Women’s National Basketball League (WNBL). They are the only professional sporting team of any discipline in the northern half of Australia.**

The Townsville Fire was established for the 2001/2002 WNBL season by the Townsville Basketball Inc. but folded at the end of the 2010/2011 season. The team was reformed by the 2011/2012 season and made the Grand Finals in the 2012/2013 and 2013/2014 seasons. In 2014 Townsville Fire announced that James Cook University would be the principal partner for 3 years and the team would be known as the JCU Townsville Fire for this period.

So who is on the team? In October 2017, these are the players and their heights.

**Table 1. 2017-2018 JCU Townsville Fire Roster**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Position** | **Number** | **Nationality** | **Name** | **Height (m)** |
| SG | 1 | USA | MINCY, Laurin | 1.83 |
| SG | 3 | Aust | GOODCHILD, Miela | 1.75 |
| PG | 6 | “ | DONNELLY, Mikhaela | 1.73 |
| SG | 7 | “ | ANDREWS, Haylee | 1.75 |
| C | 8 | “ | BATKOVIC, Suzy (Captain) | 1.94 |
| SF | 10 | “ | MURRAY, Mia | 1.84 |
| PF | 14 | “ | GARBIN, Darcee | 1.88 |
| C | 15 | “ | AOKUSO, Zitina | 1.92 |
| SF | 21 | “ | WHITTLE, Marena | 1.80 |
| PG | 22 | “ | WILSON, Kelly | 1.70 |
| PF | 23 | “ | GEORGE, Cayla | 1.93 |
| SG | 24 | USA | WIESE, Sydney | 1.83 |
| PG | 32 | Aust | COCKS, Micaela | 1.74 |

Legend: C – Centre; PF – Power Forward; PG – Point guard; SF – Small Forward; SG – Shooting Guard

1. What do you understand by the term *data*? What data is present in Table 1?

Solve

*SOLUTION*

*We can collect 3 different types of data:*

*Categorical data*:

* *Information that can be sorted into groups of the same type eg. eye colour of a group of students; favourite fruit of a group of students*

*Discrete data:*

* *Data that is counted eg. the number of emails you receive a day; the number of runs scored by a female cricketer*

*Continuous Data:*

* *Data that is measured eg. weights of newborn babies; volume of water in the Townsville Dam each day.*

*Data in Table 1:*

*Categorical data – position (SG -4; PG-2; SG-2; C-1; SF-2; PF-2); nationality (USA & Aust)*

*Discrete –*

*Continuous data – height (in metres)*

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1. To analyse the data relating to player heights, we can do a number of calculations. We can calculate the mean, the median, the mode, the range and the maximum and/or minimum scores. Each type of calculation tells us something different about basketballer heights. Think about what each measure can tell you and then complete **the first three columns only** in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Statistical measures | What can we find out with these measures? | | Perform some calculations (show your working here or on the next page) | | |
| What do you understand about these words? | What does this measure tell you about this dataset (heights of players in an WNBL team)? | Calculate for the 13 Townsville Fire players | Calculate for (top of the table) | Calculate (bottom of the table) |
| Mean | Mean – Average value  Note: Mean - The sum of all the data values in the data set divided by the number of values in that data set.  (HINT: Think of another word that is commonly used for *mean*) |  | **1.82m**  See *(1)* On next page. |  |  |
| Median | The middle value of an ordered data set. |  | **1.83m**  See *(2)* On next page. |  |  |
| Mode | The value that occurs most often in a data set. |  | Bimodal (**1.75m & 1.83m**)  See *(3)* On next page. |  |  |
| Maximum | The largest data value. |  | **1.94m** |  |  |
| Minimum | Smallest data value. |  | **1.70m** |  |  |
| Range | The largest data value less the smallest data value.  Note: Range is the first measure of statistical spread dealt with. It gives an idea of how far spread the data values are in a data set. |  | 1.94 – 1.70 = **0.24m**  See *(4)* On next page. |  |  |

**Workings for Question 4**. (Townsville Fire)

*SOLUTION (Townsville Fire)*

*(1)* ***Mean***

*Ordered data (Heights)*

*1.70, 1.73, 1.74, 1.75, 1.75, 1.80,* **1.83***, 1.83, 1.84, 1.88, 1.92, 1.93, 1.94*

*Mean = *

*= *

*(2)* ***Median***

*As there is an odd number of data values (13), select the middle value (ie. 7th value),* ***1.83m****.*

*(3)* ***Mode***

*As there are 2 data values (ie.* ***1.75 & 1.83****) that occur most often in the data set, the results in this data set are* ***bimodal****.*

*(4)* ***Range***

*Range = Largest data value – smallest data value*

*Range = 1.94 – 1.70 =* ***0.24m***

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1. Now perform the same calculations for the “Sydney Uni Games” players who were in first place on the Championship ladder at the time these statistics were captured and the “Canberra Capitals” who were in last place. The data you will need is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| Sydney Uni Games players | | Canberra Capitals players | |
| **Name** | **Height (m)** | **Name** | **Height (m)** |
| [Walmsley, Susannah](https://en.wikipedia.org/w/index.php?title=Susannah_Walmsley&action=edit&redlink=1) | 1.70 | [Bass, Mistie](https://en.wikipedia.org/wiki/Mistie_Bass) | 1.93 |
| [Moffatt, Hayley](https://en.wikipedia.org/wiki/Hayley_Moffatt) | 1.76 | [Magbegor, Eziyoda](https://en.wikipedia.org/wiki/Eziyoda_Magbegor) | 1.93 |
| [Tupaea, Tahlia](https://en.wikipedia.org/wiki/Tahlia_Tupaea) | 1.75 | [Hurst, Natalie](https://en.wikipedia.org/wiki/Natalie_Hurst) **(C)** | 1.63 |
| [Hamson, Jennifer](https://en.wikipedia.org/wiki/Jennifer_Hamson) | 2.00 | [Bourne, Callie](https://en.wikipedia.org/w/index.php?title=Callie_Bourne&action=edit&redlink=1) | 1.80 |
| [McLean, Cassidy](https://en.wikipedia.org/w/index.php?title=Cassidy_McLean&action=edit&redlink=1) | 1.78 | [Gaze, Kate](https://en.wikipedia.org/wiki/Kate_Gaze) | 1.78 |
| [Wilson, Alex](https://en.wikipedia.org/wiki/Alex_Wilson_(basketball)) | 1.80 | [Jarry, Rachel](https://en.wikipedia.org/wiki/Rachel_Jarry) | 1.85 |
| [Greaves, Shanae](https://en.wikipedia.org/wiki/Shanae_Greaves) | 1.85 | [Wehrung, Abigail](https://en.wikipedia.org/wiki/Abigail_Wehrung) | 1.78 |
| [Ebzery, Katie-Rae](https://en.wikipedia.org/wiki/Katie-Rae_Ebzery) | 1.78 | [Paalvast, Chevannah](https://en.wikipedia.org/wiki/Chevannah_Paalvast) | 1.80 |
| [Boag, Carly](https://en.wikipedia.org/wiki/Carly_Boag) | 1.88 | [Froling, Keely](https://en.wikipedia.org/wiki/Keely_Froling) | 1.88 |
| [Snell, Belinda](https://en.wikipedia.org/wiki/Belinda_Snell) **(C)** | 1.80 | [Scherf, Lauren](https://en.wikipedia.org/wiki/Lauren_Scherf) | 1.96 |
| [McSpadden, Lara](https://en.wikipedia.org/wiki/Lara_McSpadden) | 1.94 | [Rocci, Maddison](https://en.wikipedia.org/w/index.php?title=Maddison_Rocci&action=edit&redlink=1) | 1.67 |
| [Taylor, Asia](https://en.wikipedia.org/wiki/Asia_Taylor) | 1.85 | [Hooper, Jordan](https://en.wikipedia.org/wiki/Jordan_Hooper) | 1.88 |
| [Graham, Sarah](https://en.wikipedia.org/wiki/Sarah_Graham_(basketball)) | 1.63 | [Bass, Mistie](https://en.wikipedia.org/wiki/Mistie_Bass) | 1.93 |
| [Walmsley, Susannah](https://en.wikipedia.org/w/index.php?title=Susannah_Walmsley&action=edit&redlink=1) | 1.70 | [Magbegor, Eziyoda](https://en.wikipedia.org/wiki/Eziyoda_Magbegor) | 1.93 |

**Workings for Question 5** (Sydney Uni)

*SOLUTION (Sydney Uni)*

*(1)* ***Mean***

*Ordered data (Heights) – Sydney Uni*

*1.63, 1.70, 1.70, 1.75****,*** *1.76, 1.78,* **1.78, 1.80***, 1.80, 1.85, 1.85, 1.88, 1.94, 2.00*

*Mean = *

*= *

*(2)* ***Median***

*As there are an even number of data values (14), select the 2 middle values (ie. 7th and 8th values – 1.78 and 1.80), and take the mean of these 2 values, eg, (1.78 + 1.80) ÷ 2 = 3.58 ÷ 2 =* ***1.79m.***

*(3)* ***Mode*** *(Sydney Uni – cont)*

*As there are 4 data values (ie. 1.70, 1.78, 1.80 & 1.85) that occur most often in the data set, the results in this data set are* ***multimodal****.*

*Note: The mode is not very useful in a multimodal set of data, and sometimes it is said that the data sets have no mode!*

*(4)* ***Range***

*Range = Largest data value – smallest data value*

*Range = 2.00 – 1.63 =* ***0.37m***

**Workings for Question 5** (Canberra Capitals)

*SOLUTION (Canberra Capitals)*

*(1)* ***Mean***

*Ordered data (Heights)*

*1.63, 1.67, 1.78, 1.78, 1.80, 1.80,* **1.85, 1.88***, 1.88, 1.93, 1.93, 1.93, 1.93, 1.96*

*Mean = *

*= *

*(2)* ***Median***

*As there are an even number of data values (14), select the 2 middle values (ie. 7th and 8th values – 1.85 and 1.88), and take the mean of these 2 values, eg, (1.85 + 1.88) ÷ 2 = 3.73 ÷ 2 = 1.865 ≈ 1****.87m***

*(3)* ***Mode***

*The value that occur most often (4 times) in the data set, is* ***1.93m****.*

*(4)* ***Range***

*Range = Largest data value – smallest data value*

*Range = 1.96 – 1.63 =* ***0.33m***

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1. Which combination of statistical measures (mean, median, mode, maximum, minimum, range) would be the best ones to use to compare the heights of the teams? Why?

Evaluate & verify

**Workings for Question 6** (3 Teams)

*SOLUTION*

**Teams (3) – Data Comparison Table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Data** | **Townsville Fire (m)** | **Sydney Uni (m)** | **Canberra Capitals (m)** | **Comments** |
| Mean | 1.82 | 1.73 | 1.77 |  |
| Median | 1.83 | 1.79 | 1.87 |  |
| Mode | Bimodal (1.75 & 1.83) | Multimodal (1.70, 1.78, 1.80 & 1.85) | 1.93 | Not useful measures |
| Maximum | 1.94 | 2.00 | 1.96 |  |
| Minimum | 1.70 | 1.63 | 1.63 |  |
| Range | 0.24 | 0.37 | 0.33 |  |
|  |  |  |  |  |

*Mean, maximum, minimum and range measures would be most suitable statistical measures as they give detailed height measures of each team.*

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1. Which measure/s are not very useful in this kind of situation and why not?

*Mode is not a useful measure with these 3 teams as Sydney Uni results are bimodal (4 values with maximum frequency) and this creates difficulty with team ‘Mode’ comparisons.*

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Communicate

1. Using **at least two different measures** to justify your answer, which team would you say could call themselves the “tallest” team for the 2017/18 season?

*As Townsville Fire has the smallest range of player height measures (0.24m or 24cm) and the largest mean height (1.82m), the team could be called the tallest team for the 2017/2018 season.*

1. The Townsville Fire and Sydney Uni Games are well above the Canberra Capitals at this stage of the season. Based on your data analysis, would you say that height might be a significant factor for the Canberra Capitals’ poor season so far? Justify your response using some of your previous calculations.

*Teams with players under 1.80m in height are as follows:*

* *Townsville Fire - 4 players*
* *Sydney Uni – 7 players*
* *Canberra Capitals – 4 players*

*Also, Teams with players over 1.90m in height are as follows:*

* *Townsville Fire - 3 players*
* *Sydney Uni – 2 players*
* *Canberra Capitals – 5 players*

*Height of Canberra Capitals players is not a significant factor in their poor 2017/2018 Season performance to date, as with a Median height of 1.87m (the greatest of the 3 teams) and a Mode of 1.93m (4 players), height is not an issue, so other factors may require investigation as to their poor performance.*

**Sources for local information**:

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

<https://en.wikipedia.org/wiki/2017%E2%80%9318_Townsville_Fire_season>

<https://en.wikipedia.org/wiki/2017%E2%80%9318_Sydney_Uni_Flames_season>

<https://en.wikipedia.org/wiki/2017%E2%80%9318_Canberra_Capitals_season>