Men's Long Jump

Teacher Notes and Answers

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TI-Nspire CXII/CXII CAS


Investigation


Student


60+ min

Background

Additional resources: *Men's Long Jump Student Nspire File.tns*

Equipment: Measuring tape or metre ruler and access to YouTube.

In this task, you are asked to analyse data from the Summer Games men's long jump competition (1896 – 2016).

Before analysing the data, your teacher will ask two volunteers to measure out 8.90 metres (Bob Beamon's famous jump at the 1968 Summer Games).

A video of Beamon's jump can be accessed from:

http://www.youtube.com/watch?v=DEt_Xgg8dzc

Summer Games Men's Long Jump Data

The table below shows the men's winning long jump length and the gold medalist's nationality for each Summer Games held since 1896.

Year	1896	1900	1904	1908	1912	1920	1924	1928	1932	1936	1948
Length (m)	6.35	7.185	7.34	7.48	7.60	7.15	7.44	7.73	7.64	8.06	7.825
Nationality	USA	USA	USA	USA	USA	SWE	USA	USA	USA	USA	USA

Year	1952	1956	1960	1964	1968	1972	1976	1980	1984	1988	1992
Length (m)	7.57	7.83	8.12	8.07	8.90	8.24	8.35	8.54	8.54	8.72	8.67
Nationality	USA	USA	USA	GBR	USA	USA	USA	GDR	USA	USA	USA

Year	1996	2000	2004	2008	2012	2016	2020
Length (m)	8.50	8.55	8.59	8.34	8.31	8.38	?
Nationality	USA	CUB	USA	PAN	GBR	USA	?

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Part 1: Univariate Statistics

Question A

State why the Summer Games were not held in the years 1916, 1940 and 1944.

Question B

Name the only long jumper to have won more than one Summer Games gold medal in the men's long jump. How many Summer Games men's long jump gold medals did he win?

Question C

Represent the nationalities of Summer Games men's long jump gold medallists in the form of

(i) a column graph (bar chart). (ii) a pie chart.

Question D

State the percentage of gold medallists in the Summer Games men's long jump whose nationality is the United States of America (USA). Give your answer correct to one decimal place.

Question E

Use one-variable statistics to calculate the mean (average) winning Summer Games men's long jump length. Give your answer correct to two decimal places.

Question F

Use one-variable statistics to calculate the median winning Summer Games men's long jump length. Give your answer correct to two decimal places.

Question G

Calculate

(i) the range of winning Summer Games men's long jump lengths.

(ii) the interquartile range of winning Summer Games men's long jump lengths.

[Hint: On a calculator page, press var to access the statistics variables **stat.maxx**, **stat.minx**, **stat.q$_3$x** and **stat.q$_1$x** as needed.]

Question H

Represent the winning Summer Games men's long jump lengths in the form of a box plot.

Question I

Use the box plot to determine whether this data set is negatively skewed or positively skewed. Give two reasons to support your answer.

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Question J

Determine whether the winning jump of 8.90 metres in 1968 can be classified statistically as an outlier.

Part 2: Bivariate Statistics

For questions K to S, consider 'year' to be the independent variable and 'length' to be the dependent variable.

Question K

Represent the winning Summer Games men's long jump lengths over the period 1896 – 2016 in the form of a scatter plot.

Question L

Represent the winning Summer Games men's long jump lengths over the period 1896 – 2016 in the form of a line graph (XY line plot).

Question M

Describe any trends shown by the line graph sketched in question (L).

Question N

Is the relationship (association) between the variables 'year' and 'length' positive or negative?

Question O

Use the movable line feature to draw a line of good fit through the points. Your teacher will explain the purpose of this line and how to move it.

> [Hint: Ensure that the 'show residual squares feature' is turned on. Your teacher will explain the purpose of this feature. On a data & statistics page, press **menu** > **Analyze** > **Add Movable Line**. Press **menu** > **Analyze** > **Residuals** > **Show Residual Squares**.]

Question P

State the equation of your line of good fit in the form $y=mx+b$. Give your values of m and b correct to three decimal places.

Question Q

Use your line of good fit to predict the winning men's long jump length at the 1956 Melbourne Summer Games. Express your answer correct to two decimal places.

> [Hint: If your movable line is ***m1***(***x***), calculate the value of ***m1***(1956).]

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Question R

Use your value of *m* obtained in part (p) to describe what your line of good fit predicts for the winning men's long jump length at any two successive Summer Games.

Question S

Use your line of good fit to predict the winning men's long jump length at the 2020 Tokyo Summer Games. Express your answer correct to two decimal places. Briefly comment on the winning men's long jump length predicted by your line of good fit.

Extension 1

Repeat parts (p) – (s) using the equation of the least squares regression line (line of best fit) for the 1896 – 2016 Summer Games men's long jump competition.

[Hint: To add the least squares regression line to a scatter plot, press **menu** > **Analyze** > **Regression** > **Show Linear (mx+b)**.

[Hint: To use the least squares regression equation, press **menu** > **Statistics** > **Stat Calculations** > **Linear Regression (mx+b)**. In the X list field, select **year**. In the Y list field, select **length**. The equation of the line of best fit is saved in **f1**.]

Extension 2

Repeat parts (p), (q) and (s) using the equation of the quadratic regression curve for the 1896 – 2016 Summer Games men's long jump competition. Give your quadratic equation correct to six decimal places.

Compare the linear and quadratic models.

[Hint: To add the quadratic regression curve to a scatter plot, press **menu** > **Analyze** > **Regression** > **Show Quadratic**.

[Hint: To use the quadratic regression equation, press **menu** > **Statistics** > **Stat Calculations** > **Quadratic Regression**.]

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