Comparison of Cylindar Count to Engine Displacement'

Introduction

Our client, Big Dawg, wants to know if having more cylinders in a car's engine actually means a larger engine size. He thinks that more cylinders don't always lead to a bigger engine. To find out, we'll use data from the `mtcars` dataset in R to check the average engine size (displacement) for cars with different numbers of cylinders.

In this report, we'll show the results in both a table and a chart. Using Quarto. This analysis will help Big Dawg see whether his belief about cylinders and engine size is accurate.

1. Loading Necessary Libraries

```
library(ggplot2)
library(dplyr)
library(knitr)
library(kableExtra)
```

- **ggplot2**: Used for creating the bar chart.
- **dplyr**: Used for data manipulation, particularly grouping and summarizing data.
- **knitr** and **kableExtra**: Used to create and style the table for displaying results.

2. Loading the `mtcars` Dataset

```
data(mtcars)
head(mtcars)
```

```
                   mpg cyl disp  hp drat    wt  qsec vs am gear carb
Mazda RX4          21.0  6  160 110 3.90 2.620 16.46  0  1    4    4
Mazda RX4 Wag      21.0  6  160 110 3.90 2.875 17.02  0  1    4    4
Datsun 710         22.8  4  108  93 3.85 2.320 18.61  1  1    4    1
Hornet 4 Drive     21.4  6  258 110 3.08 3.215 19.44  1  0    3    1
Hornet Sportabout  18.7  8  360 175 3.15 3.440 17.02  0  0    3    2
Valiant            18.1  6  225 105 2.76 3.460 20.22  1  0    3    1
```

```
colnames(mtcars)
```

```
 [1] "mpg"  "cyl"  "disp" "hp"   "drat" "wt"   "qsec" "vs"   "am"   "gear"
[11] "carb"
```

The column names of the `mtcars` dataset that we want are as follows:

1. **mpg**: Miles per gallon (fuel efficiency)

2. **cyl**: Number of cylinders

3. **disp**: Engine size (displacement)

3. Calculating the Mean Engine Size by Cylinder Count

```
mean_displacement <- mtcars %>%
  group_by(cyl) %>%
  summarise(
    mean_displacement = mean(disp, na.rm = TRUE)
  ) %>%
  arrange(cyl)
```

- `group_by(cyl)`: Groups the data by the number of cylinders.

- `summarise(mean_displacement = mean(disp, na.rm = TRUE))`: Calculates the mean engine size (`disp`) for each group (cylinder count). The `na.rm = TRUE` argument ignores any missing values.

- `arrange(cyl)`: Orders the resulting data by cylinder count in ascending order.

The result, `mean_displacement`, is showing the average engine size for each cylinder count.

```
mean_displacement %>%
  kable(
    col.names = c("No. of Cylinders", " Mean Size"),
    caption = "Mean Engine Size by Number of Cylinders"
  ) %>%
  kable_styling(
    bootstrap_options = c("striped", "hover", "condensed", "responsive"),
    font_size = 12
  )
```
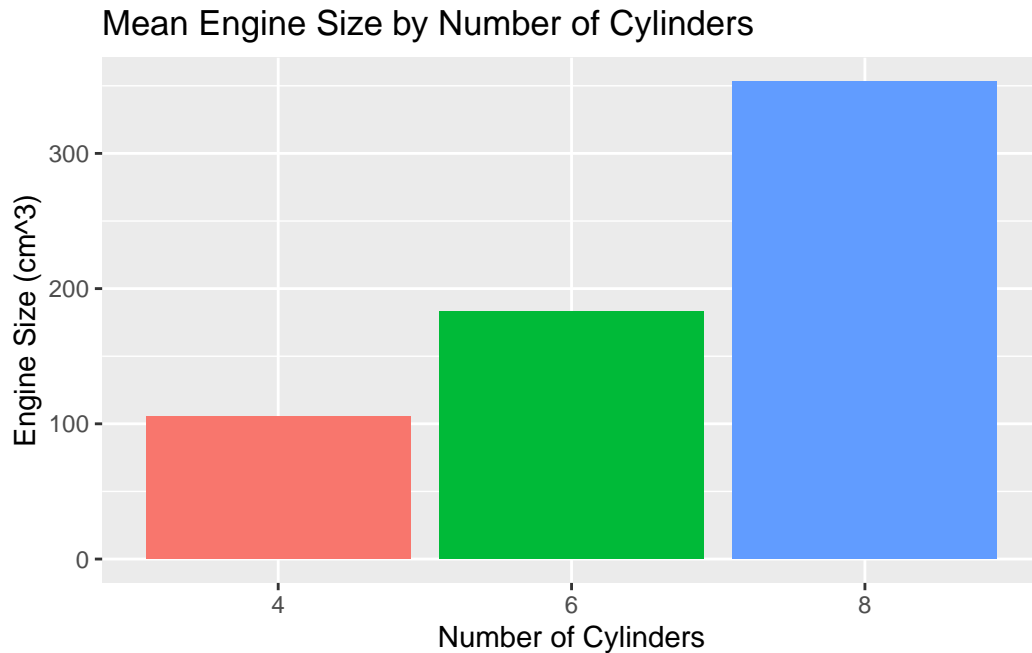
Table 1: Mean Engine Size by Number of Cylinders

No. of Cylinders	Mean Size
4	105.1364
6	183.3143
8	353.1000

- `kable()`: Creates a basic table with `mean_displacement` data. The `col.names` argument customizes column names, and `caption` adds a title.

- `kable_styling()`: Adds style options like `striped` (alternating row colors), `hover` (highlight rows on hover), `condensed` (compact format), and `responsive` (adjusts size for different screen widths). `font_size` adjusts the table font size.

This results in a nicely formatted table showing mean engine size by cylinder count.

5. Creating a Bar Chart

```
mean_displacement %>%
  ggplot(aes(x = factor(cyl), y = mean_displacement, fill = factor(cyl))) +
  geom_bar(stat = "identity", show.legend = FALSE) +
  labs(
    x = "Number of Cylinders",
    y = "Engine Size (cm^3)",
    title = "Mean Engine Size by Number of Cylinders"
  )
```

Mean Engine Size by Number of Cylinders

- **mean_displacement %>%**: Uses the **mean_displacement** data, which shows average engine sizes by cylinder count.

- **ggplot(aes(x = factor(cyl), y = mean_displacement, fill = factor(cyl)))**: Sets up the bar chart with the number of cylinders on the x-axis and average engine size on the y-axis, with each cylinder count shown in a different color.

- **geom_bar(stat = "identity", show.legend = FALSE)**: Creates bars with heights based on the actual average engine sizes and removes the legend.

- **labs()**: Adds labels to the x-axis, y-axis, and title for clarity.

The chart shows that as the number of cylinders in a car's engine increases, the average engine size also increases:

- Cars with 4 cylinders have the smallest average engine size.

- Cars with 6 cylinders have a larger average engine size.

- Cars with 8 cylinders have the largest average engine size.

Conclusion

This analysis suggests that cars with more cylinders generally have larger engines, supporting the idea that cylinder count is related to engine size. This result contradicts Big Dawg's belief that more cylinders don't necessarily mean a bigger engine.