

Introduction challenge exercises

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Challenge 1

Using the `ifelse` function, create a new column “hydroyear” in the `CAN01AD002` data frame. If the month is 10 or greater, the hydro year is one greater than the year. Otherwise, it is the current year. Hint: you can use the `format` command to get the month from the date.

```
library(CSHShydRology)
CAN01AD002 <- CAN01AD002
CAN01AD002$year <- as.numeric(format(CAN01AD002$date, format = "%Y"))
CAN01AD002$month <- as.numeric(format(CAN01AD002$date, format = "%m"))
CAN01AD002$hydroyear <- ifelse(CAN01AD002$month < 10, CAN01AD002$year, CAN01AD002$year + 1)
summary(CAN01AD002)
```

```
##      date              flow      year      month
## Min.   :1926-10-01   Min.    : 14.4   Min.    :1926   Min.    : 1.000
## 1st Qu.:1948-10-23   1st Qu.: 70.8   1st Qu.:1948   1st Qu.: 4.000
## Median :1970-11-15   Median : 136.0   Median :1970   Median : 7.000
## Mean   :1970-11-15   Mean    : 278.8   Mean    :1970   Mean    : 6.536
## 3rd Qu.:1992-12-07   3rd Qu.: 295.8   3rd Qu.:1992   3rd Qu.:10.000
## Max.   :2014-12-31   Max.    :4630.0   Max.    :2014   Max.    :12.000
##      hydroyear
## Min.    :1927
## 1st Qu.:1949
## Median :1971
## Mean    :1971
## 3rd Qu.:1993
## Max.    :2015
```

Challenge 2

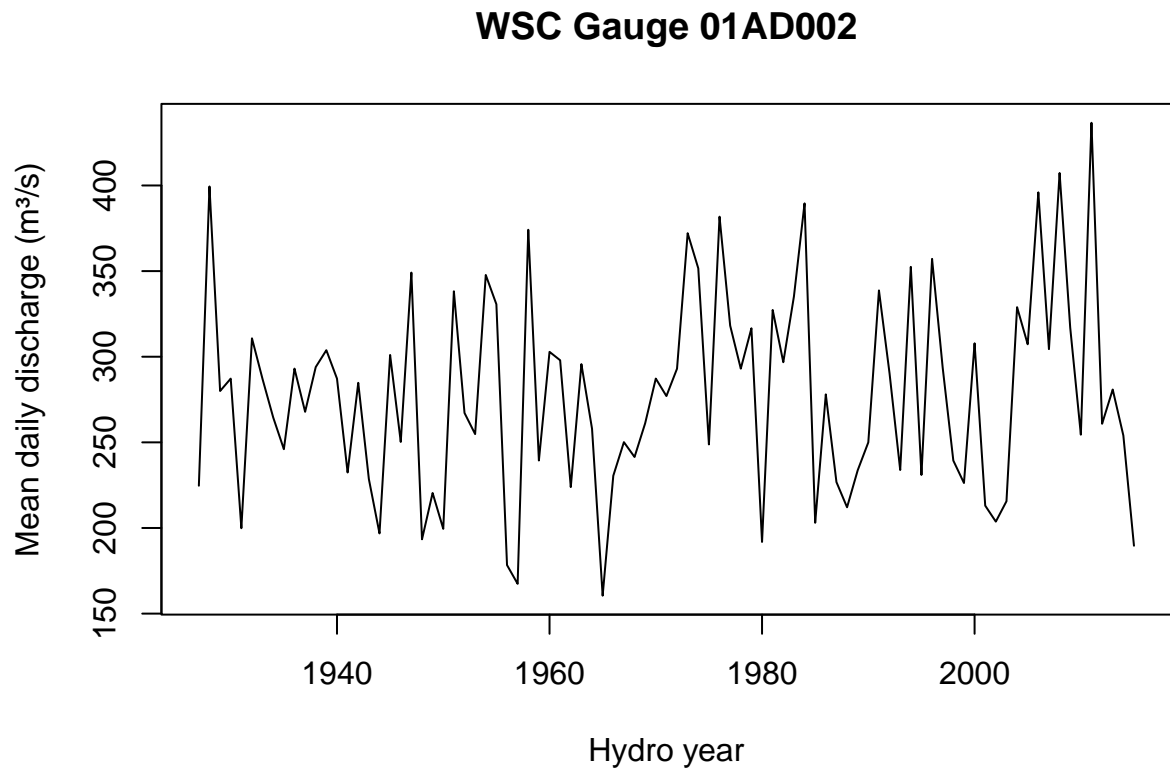
Get the mean daily discharge for each hydro year. Plot the values.

```
hydro_year_mean <- aggregate(flow~hydroyear, data = CAN01AD002, FUN = "mean")
summary(hydro_year_mean)
```

```
##      hydroyear      flow
## Min.    :1927   Min.    :160.5
## 1st Qu.:1949   1st Qu.:232.4
## Median :1971   Median :280.0
## Mean    :1971   Mean    :278.0
## 3rd Qu.:1993   3rd Qu.:310.8
## Max.    :2015   Max.    :436.6
```

Using standard plotting

```
plot(hydro_year_mean, xlab = "Hydro year", ylab = "Mean daily discharge (m³/s)",  
     main = "WSC Gauge 01AD002", type = "l")
```

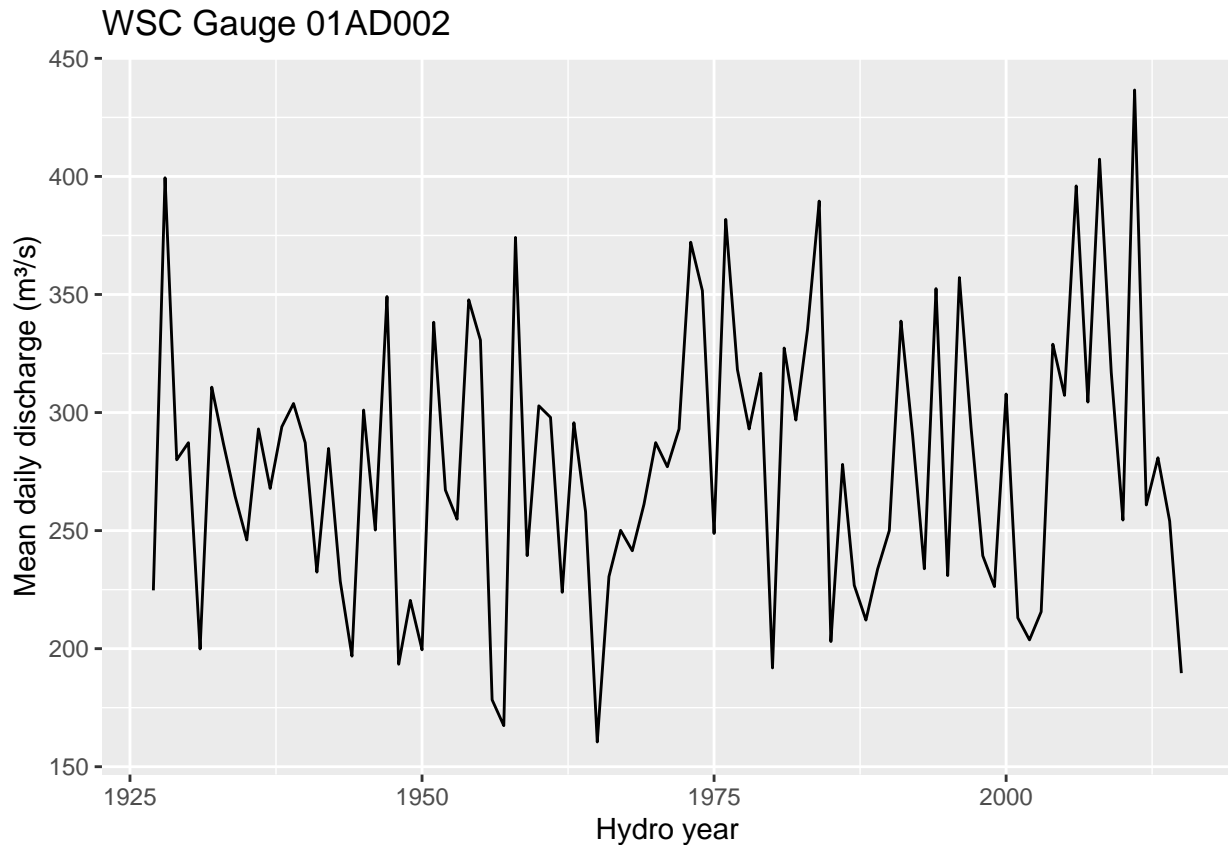


###

Using ggplot2

```
library(ggplot2)  
p <- ggplot(hydro_year_mean, aes(hydroyear, flow)) +  
  geom_line() +  
  xlab("Hydro year") +  
  ylab("Mean daily discharge (m³/s)") +  
  ggtitle("WSC Gauge 01AD002")
```

p



Challenge 3

Classify the daily flows by quarter: Q1 = Jan-Mar, Q2 = April-June, Q3 = July-September, Q4 = October-December. Plot histograms of the daily flows faceted by each quarter using **ggplot2** with the function `facet_wrap`.

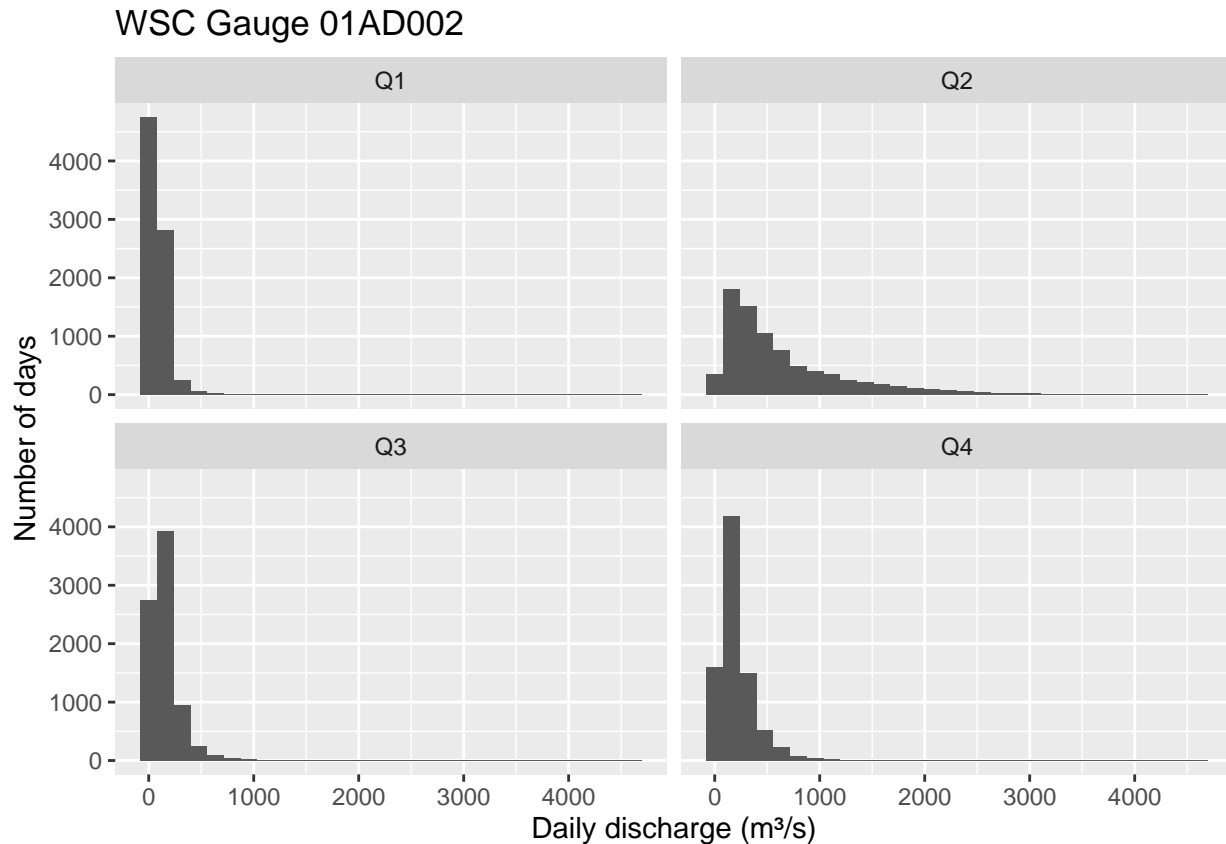
Solve using `ifelse`

```
CAN01AD002$quarter <- ifelse(CAN01AD002$month <= 3, "Q1",
                             ifelse(CAN01AD002$month <= 6, "Q2",
                                     ifelse(CAN01AD002$month <= 9, "Q3", "Q4")))
summary(CAN01AD002)
```

```
##      date              flow              year      month
## Min.   :1926-10-01   Min.    : 14.4   Min.    :1926   Min.    : 1.000
## 1st Qu.:1948-10-23   1st Qu.: 70.8   1st Qu.:1948   1st Qu.: 4.000
## Median :1970-11-15   Median : 136.0   Median :1970   Median : 7.000
## Mean   :1970-11-15   Mean    : 278.8   Mean    :1970   Mean    : 6.536
## 3rd Qu.:1992-12-07   3rd Qu.: 295.8   3rd Qu.:1992   3rd Qu.:10.000
## Max.   :2014-12-31   Max.    :4630.0   Max.    :2014   Max.    :12.000
## hydroyear    quarter
## Min.   :1927   Length:32234
## 1st Qu.:1949   Class :character
## Median :1971   Mode  :character
## Mean    :1971
## 3rd Qu.:1993
## Max.    :2015
```

Plot using ggplot2

```
p <- ggplot(CAN01AD002, aes(flow)) +
  geom_histogram() +
  xlab("Daily discharge (m³/s)") +
  ylab("Number of days") +
  ggtitle("WSC Gauge 01AD002") +
  facet_wrap(~quarter)
p
```



Solve using factors

```
CAN01AD002$quarter <- ifelse(CAN01AD002$month <= 3, "Jan-Mar",
  ifelse(CAN01AD002$month <= 6, "Apr-Jun",
    ifelse(CAN01AD002$month <= 9, "Jul-Sept", "Oct-Dec")))

CAN01AD002$quarter <- factor(CAN01AD002$quarter,
  levels = c("Jan-Mar", "Apr-Jun", "Jul-Sept", "Oct-Dec"))

summary(CAN01AD002)
```

##	date	flow	year	month
##	Min. :1926-10-01	Min. : 14.4	Min. :1926	Min. : 1.000
##	1st Qu.:1948-10-23	1st Qu.: 70.8	1st Qu.:1948	1st Qu.: 4.000
##	Median :1970-11-15	Median : 136.0	Median :1970	Median : 7.000
##	Mean :1970-11-15	Mean : 278.8	Mean :1970	Mean : 6.536
##	3rd Qu.:1992-12-07	3rd Qu.: 295.8	3rd Qu.:1992	3rd Qu.:10.000
##	Max. :2014-12-31	Max. :4630.0	Max. :2014	Max. :12.000

```
##      hydroyear      quarter
## Min.   :1927   Jan-Mar :7942
## 1st Qu.:1949   Apr-Jun :8008
## Median :1971   Jul-Sept:8096
## Mean   :1971   Oct-Dec :8188
## 3rd Qu.:1993
## Max.    :2015
```

Plot using ggplot2

```
p2 <- ggplot(CAN01AD002, aes(flow)) +
  geom_histogram() +
  xlab("Daily discharge (m³/s)") +
  ylab("Number of days") +
  ggtitle("WSC Gauge 01AD002") +
  facet_wrap(~quarter)
```

p2

