Activity 3

Name here

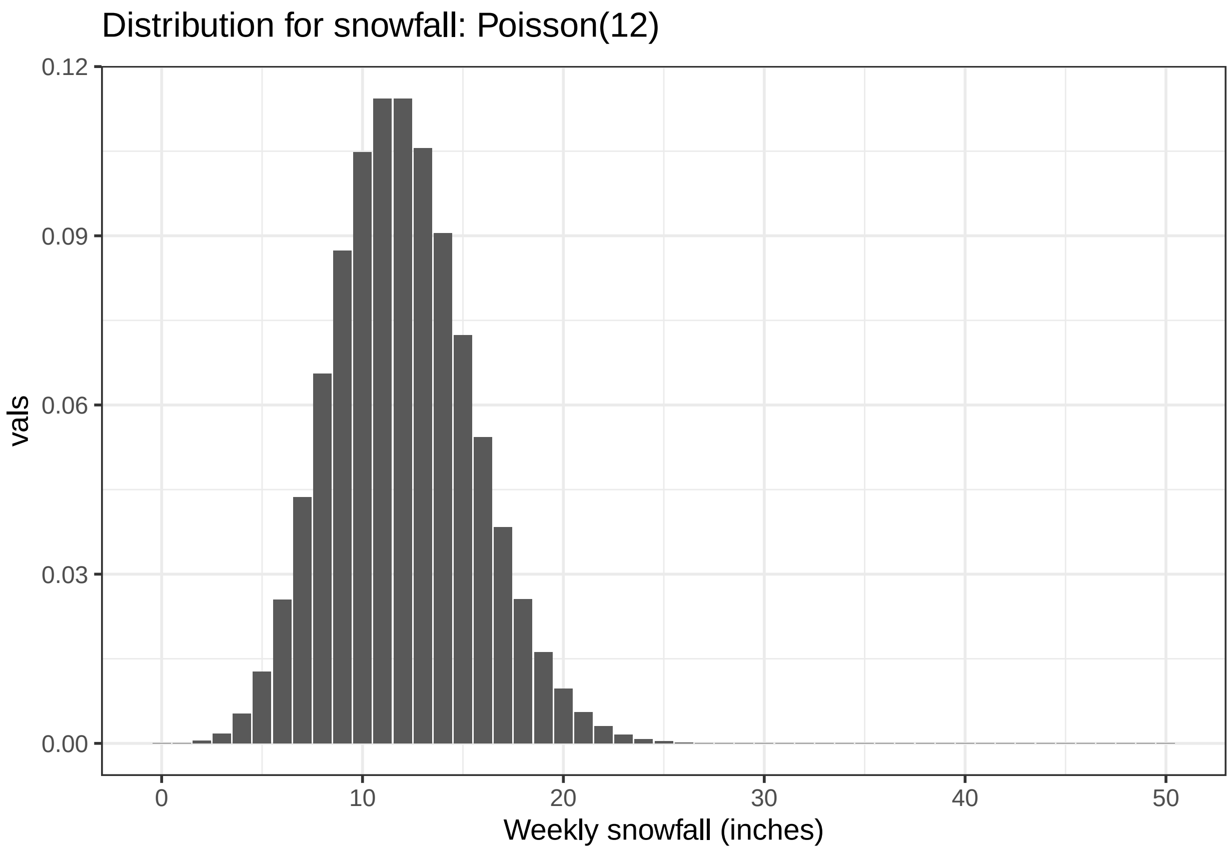
Q1.

Suppose we have a probability mass function for weekly winter snowfall at bridger bowl that temperature in Hyalite that is Poisson with mean of 12 inches. This

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.4.0     v purrr   0.3.4
## v tibble  3.1.8     v dplyr   1.0.9
## v tidyr   1.2.0     v stringr 1.4.1
## v readr   2.1.2     v forcats 0.5.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
snow_seq <- 0:50
tibble(vals = c(dpois(snow_seq, 12)),
       `Weekly snowfall (inches)` = snow_seq) %>%
  ggplot(aes(x = `Weekly snowfall (inches)`, y = vals)) +
  geom_col() + theme_bw() +
  ggtitle(expression(paste('Distribution for snowfall: Poisson(12)')))
```



Answer the following questions with an numeric answer and a description of why that answer is true.

- According to this distribution, what is the probability of a week having 12 inches of snow? (Hint `dpois()`)

The probability is 0.11. With a discrete variable, this is the height of the probability mass function. We can use `dpois` in R.

- According to this distribution, what is the probability of a week having more than 12 inches of snow? (Hint `ppois()`)

The probability is 0.42. Here we are finding the area of the mass function which is greater than 12. We can use `ppois` in R.

- According to this distribution, what is the probability of a week having 33 inches of snow (As of Jan 29, Bridger Bowl has reported 33 inches in last week)?

The probability of this occurrence is very small, specifically it is 2.9024293×10^{-7}.

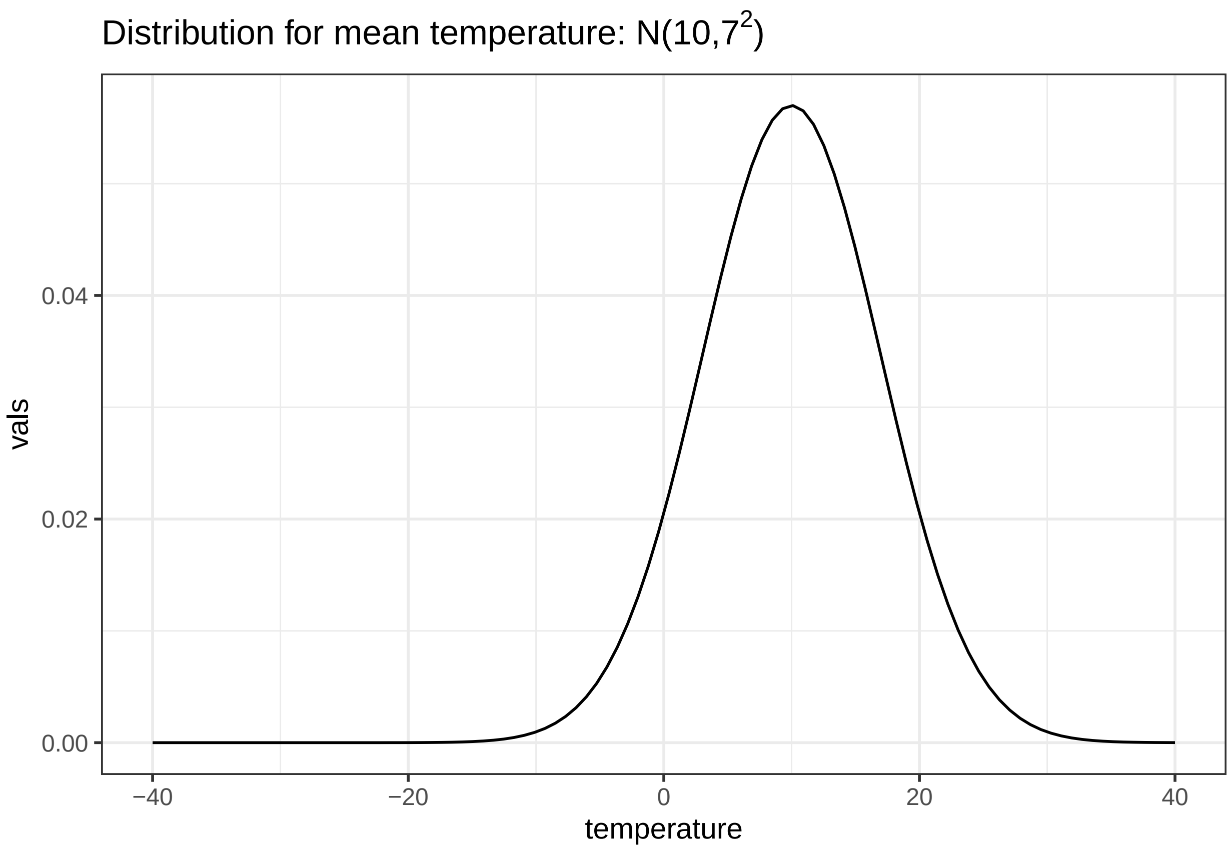
- Based on the last question, do you have any concerns with this function for snowfall?

The probability of this occurrence is very small, specifically it is 2.9024293×10^{-7}. *This suggests either the last week was really unusual or the probability model has some issues. Based on my experiences, it is likely a little of both. However, this last week wasn't as unusual as suggested by the model; rather, a model that has greater variability (maybe negative binomial) might better explain nature.*

Q2.

Suppose we have a probability distribution for average temperature in Hyalite that is Normal with mean = 10 and standard deviation = 7.

```r
temp_seq <- seq(-40,40, length.out = 100)
tibble(vals = c(dnorm(temp_seq, 10, 7)),
       temperature = temp_seq) %>%
  ggplot(aes(x = temperature, y = vals)) +
  geom_line() + theme_bw() +
  ggtitle(expression(paste('Distribution for mean temperature: N(10,',7^2,')')))
```



Answer the following questions with an numeric answer and a description of why that answer is true.

- What is the probability that the temperature is greater than 10 degrees?

The probability is $\frac{1}{2}$. The normal distribution is symmetric, so we have equal probability of a value being greater and lower than the mean.

- What is the probability that the temperature is less than 0 degrees? (Hint `pnorm`)

The probability is 0.08. We are actually integrating the area of the curve less than 0 degrees. This integration can be done in R using `pnorm()`.

Q3.

Yahtzee is a dice game where players roll 5 dice. A yahtzee (all 5 dice with the same value) is worth 50 points and a large straight (a run of 5 consecutive values) is worth 40 points. Use a Monte Carlo technique to calculate the probability of each of these outcomes, given a single roll.

```r
num_sims <- 1000000

Yahtzee <- straight <- rep(FALSE, num_sims)
```

```
for (i in 1:num_sims){
  roll <- sample(6, 5, replace = T)
  Yahtzee[i] = length(unique(roll)) == 1
  straight[i] = (length(unique(roll)) == 5 & !(1 %in% roll)) | (length(unique(roll)) == 5 & !(6 %in% ro
}

mean(Yahtzee)
```

```
## [1] 0.000722
```

```
mean(straight)
```

```
## [1] 0.0311
```

The probability of a Yahtzee is 7.2×10^{-4} *and the probability of a straight is 0.0311.*