## Purpose

This work was inspired by the following email from Farmer Ben.

```
From: Ben Chan  
Sent: Thursday, June 11, 2015 4:04 PM  
To: Stephanie Renfro  
Subject: What to feed chicks  

Hello,  
I'm receiving 20 baby chicks next month. Can you help me decide what to feed them? I'm choosing between the following four diets:  
1. Grower diet  
2. Layer diet  
3. Breeder diet  
4. High cluckage diet  

Thanks,  
Ben  
```

## Preliminaries

Start clock to calculate total runtime.
```{r}
start_program <- proc.time()  
```

Load needed packages:
* *data.table* - for faster processing  
* *knitr* - for better table display (*kable* function)  
* *ggplot2* - for pretty plots
```{r, warning=FALSE}
packages <- c("data.table", "knitr", "ggplot2")  
sapply(packages, require, character.only=TRUE, quietly=TRUE)
```

Define the CHSE color palette function.
```{r}
colorPalette <- function () {  
c(rgb(  1,  67, 134, maxColorValue=255),  
rgb(119, 120, 123, maxColorValue=255),  
rgb(139, 184, 234, maxColorValue=255),  
rgb(188, 190, 192, maxColorValue=255),  
rgb( 94, 122, 162, maxColorValue=255),  
rgb(223, 122,  28, maxColorValue=255))  
}
```

## Prepare Data

This demo uses [data from an experiment on the effect of diet on early growth of chicks](http://www.inside-r.org/r-doc/datasets/ChickWeight), `ChickWeight`, which comes pre-loaded in any R session.

Let's take a look at the first few rows:
```{r}
head(ChickWeight)
```

Let's also print a summary of the data.
```
summary(ChickWeight)
```

Convert to data.table for faster processing.
```{r}
ChickWeight <- data.table(ChickWeight)
```
Just for fun, let's create a table showing mean weight at times 0, 10, and 21 days, for each of the four diet types.

```r
mean_ChickWeight <- ChickWeight [Time %in% c(0,10,21),
          list(mean_weight = round(mean(weight), digits=1)),
          by = list(Diet,Time)]
kable(mean_ChickWeight)
```

Create a character variable for `diet`.
Use this variable for plotting small multiples.

```r
ChickWeight[, dietChr := sprintf("Diet %d", Diet)]
```

### Growth for Individual Chicks
The following plot illustrates the growth curve for individual chicks from 0 to 21 days.

Colors represent the four diets.

**From this plot, it is difficult to distinguish between the performance of the four diets.**

```r
ggplot() +
  geom_line(data=ChickWeight, aes(x=Time, y=weight, color=dietChr, group=Chick)) +
  scale_color_manual(values=colorPalette()) +
  ggtitle("Growth Curve for Individual Chicks")
```

### Individual growth curves
Plot individual chick growth curves using small multiples.

```r
ggplot() +
  geom_line(data=ChickWeight, aes(x=Time, y=weight, color=dietChr, group=Chick)) +
  facet_wrap(~ dietChr, nrow=1) +
  scale_color_manual(values=colorPalette()) +
  theme(legend.position="none") +
  ggtitle(bquote(atop("Growth Curve for Individual Chicks")))
```

### Fitted growth curves
Plot fitted growth curves using small multiples. Data points are jittered around time value.

```r
ggplot() +
  geom_jitter(data=ChickWeight, aes(x=Time, y=weight, colour=dietChr)) +
  geom_smooth(data=ChickWeight, aes(x=Time, y=weight, colour=dietChr)) +
  facet_wrap(~ dietChr, nrow=1) +
  scale_color_manual(values=colorPalette()) +
  theme(legend.position="none") +
  ggtitle(bquote(atop("Fitted Growth Curves")))
```

### Final weight density
Plot densities by diet for chicks' final weights (day 21) using small multiples.

```r
ggplot(ChickWeight[Time==21], aes(x=weight, colour=dietChr, fill=dietChr)) +
  geom_density() +
  facet_wrap(~ dietChr, nrow=4) +
  scale_color_manual(values=colorPalette()) +
  scale_fill_manual(values=colorPalette()) +
  theme(legend.position="none") +
  ggtitle(bquote(atop("Density: Final Weight")))
```

## Wrap Up
Calculate total runtime.

```r
time_program <- proc.time()-start_program
print(paste("Total runtime: ", format(time_program[3]/60,digits=3), " minutes"))
```

Clear memory.

```r
rm(list=ls())
invisible(gc())
```