Trace metals in drinking water affect the flavor; high concentrations can be a health hazard. A randomized study looked at six river locations along the South Indian River (6 units) and the zinc concentration in mg/L was measured for both surface and bottom water at each location. Is there sufficient evidence the true mean difference in concentration in bottom water differs from that of surface water? Let α=0.10. Estimate the true mean difference with 90% confidence and interpret

1. Hypotheses, assumptions if requested
   $H_0: \mu_d = 0 \ \ vs. H_a: \mu_d \neq 0$
   Assumptions:
   * independence of units/subjects (randomized so yes)
   * random (yes)
   * normality: no based on graphs (realistically we would say normality is not met; in the class we are still going through this example)
   * dependence of measurements (each unit is measured twice)
2. State test statistic, df, pvalue
   t = 3.6998, df = 5, p-value = 0.014
3. State results of test
   Reject null if $pvalue \leq \alpha(0.10)$
   $pvalue = 0.014 \leq \alpha(0.10) \therefore H_0$ is rejected
4. Conclusion in context
   There is a significant difference in zinc concentration between the surface and bottom of the river sites
5. Error: since null was rejected, we could have made a Type I error. We think there is a difference in zinc concentration when there is not

CI; 0.04174206 0.14159127 ➔ (0.0417, 0.1416). We are 90% confident the true mean difference in zinc concentration between the bottom and the surface is between 0.0417 and 0.1416 mg/L. (The zinc at the bottom is between 0.0417 and 0.1416 mg/L HIGHER than at the surface

Paired t-test

data: bottom and surface
t = 3.6998, df = 5, p-value = 0.014
alternative hypothesis: true difference in means is not equal to 0
90 percent confidence interval:
0.04174206 0.14159127
sample estimates:
mean of the differences
0.09166667

let's say we have 100 candies: 10% blue, 10% yellow, 20% red, 20% brown, 30% orange, 10% green

Expected values $E = np_i$

$$E_{b,y,g} = 100(0.1) = 10$$

$$E_{r,br} = 100(0.2) = 20$$

$$E_o = 100(0.3) = 30$$