Homework 2

1. A marine science major is interested in the effect of diet upon the growth of flatfish. Two different diet regimens (A and B), two different tank temperatures (15 and 25 degrees Celsius) and two different tank sizes (Small and Large) are explored. Each of a total of eight fish are randomly assigned to one of eight tank environments. The relative growth of the fish over a one month period is recorded below. Arrange the data in a cube plot. Compute all main effects and interaction effects. Summarize, in words, the effect of each factor. Construct a normal probability plot of factor effects and identify significant effects (do not rely on Minitab's tests here). Based on the significant effects, which conditions seem most favorable for flatfish growth? Compute the EMR for these conditions.

Factor settings	Response (Relative Growth)
(A,15,Small)	18
(B,15,Small)	25
(A,25,Small)	33
(B,25,Small)	42
(A,15,Large)	21
(B,15,Large)	30
(A,25,Large)	33
(B,25,Large)	36

2. The ladder example may seem like an unfair comparison since the variance in the height estimates of the house depends on the length of the ladder as well as the nonlinearity of the sine curve. Consider an experiment in which three 24' ladders are leaned against a 10', 15' and 20' house respectively. Generate 20 estimates of the angle for each house with an angle standard deviation of 3 degrees, then compute heights for each of those estimates. As an example, for the 10' house, $\theta = sin^{-1}(10/24) = .429775 = 24.6^o$, so the angle and height estimates could be generated in Minitab by entering the following commands in the Command Line Editor window under the Edit pull-down menu and pressing Submit Commands:

```
rand 20 c1;
norm 24.6 3.
let c2=24*sin(radians(c1))
```

Alternatively, you can generate the normal random sample following the Minitab notes from the balance example, then use Calc to compute the height estimate and store it in C2. C1 now contains the angle estimates for the 24' ladder leaned against the 10' house, while C2 contains height estimates for the 10' house. Store similar estimates for the 15' and 20' houses in columns C3-C6. Following the approach in the Ladder exercise handout, compare the height estimates for the three approaches. Which house can be measured most accurately?
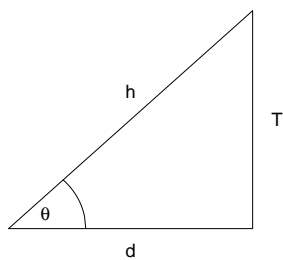
Figure 1: Tree Graphic

3. *Graduate students only.* Referring to the figure, when measuring a tree's height T, we can use the tangent method $(T = d \tan \theta)$ or the sine method $(T = h \sin \theta)$, depending on our measuring device. Suppose $\theta = 45^o$, and is measured with a standard deviation of 3°. Likewise, d is $100'$ with a measurement standard deviation of $5'$ and h is $141'$ with a measurement standard deviation of $5'$. Construct a simulation based on samples of 50 measurements of θ, h, and d. Which method is more precise?