HOMEWORK 2

Completed .Rmd files should be submitted to the appropriate dropbox on My Learning Space. When I mark your homework, the .Rmd must be able to be knitted into a report showing your R code, results of the calculations, and any necessary plots.

Hypothesis testing

The following scenarios are intended to provide an assessment of the material learned in tutorial 3. For each fictitious scenario, do the following:

a) State the null and alternative hypotheses?
b) Create a histogram of the data.
c) Explain what type of test should be used to test the hypothesis.
d) Run the appropriate test, and display the summary output.
e) Explicitly state the critical and observed value of the test statistic.
f) Indicate what conclusion you would draw from the hypothesis test.

Scenario 1
Many worry that the oil spill in the Gulf of Mexico will spell disaster for the shrimp fishing industry. Fishing communities have been expecting a collapse of the industry because of the oil sinking to the seabed. To test this hypothesis, scientists analyzed the shrimp catch from ships in 2009 and 2010 to compare the catch from a number of fishing villages around the Gulf before and after the spill.

Village Code	2009 catch (tonnes)	2010 catch (tonnes)
A	91,900	82,900
B	95,200	86,700
C	61,900	46,900
D	73,600	41,300
E	114,300	91,600
F	117,000	100,400
G	129,500	128,400
H	74,200	55,900
I	112,700	101,700
J	152,100	139,100
K	90,700	79,300
L	89,400	76,100
M	127,500	114,100
N	142,200	139,800

Has the mean shrimp catch in the Gulf changed between the 2009 and 2010 seasons?

Scenario 2

Total nutrient levels are measured as an indicator of lake "health" in many water-monitoring programs. Imports of nutrients from the catchment can cause changes in the community composition of freshwater systems. Addition of excess nutrients can increase plant production (primary production) and decreasing oxygen supply in a process referred to as eutrophication. In Lake Erie, the smallest and shallowest of the great lakes, eutrophication has been a hot topic since the 1970's when lake Erie was considered the "dead lake". (For more clarification on eutrophication see: http://www.scienceclarified.com/El-Ex/Eutrophication.html)

The guideline for total phosphorous in Lake Erie is set a maximum of 15μg/L. The following phosphorous measurements were taken from around the lake:

Site Number	Total phosphorous (μg/L)
1	18.4
2	12.9
3	15.3
4	18.3
5	15.6
6	23.3
7	16.5
8	12.3
9	24.6
10	16.2

Are the phosphorous levels in the lake higher than the guidelines?

Scenario 3

Farming of carnivorous fish consumes large quantities of fish oil that is often obtained from wild fish stocks. To improve the sustainability of the fish farming (aquaculture) industry many farmers have experimented with supplementing fish proteins with vegetable based proteins. The

following growth rates (% body weight/day) were collected from salmon placed on two distinctive diets

Trial	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Carnivorous	2.3	1.8	1.9	1.8	2.1	2.3	2.0	2.2	2.2	1.5	1.8	2.1	2.3	2.2	2.3
Vegetarian	1.6	1.1	0.7	1.0	1.0	0.9	1.2	0.8	0.9	0.6	0.7	0.6	0.8	0.8	1.1

Does the vegetarian diet differ from the carnivorous diet in terms of growth rate in farmed salmon?

Scenario 4

Polychlorinated biphenyls, more commonly known as PCB's, are a group of toxic organic compounds which were heavily used in industry as a coolants and insulating fluids. When accidently released into the environment these compounds quickly move up the food chain accumulating in the highest concentrations in the top predators. This accumulation in the highest trophic levels is referred to as biomagnification (http://www.greenfacts.org/en/pcbs/l-2/2-biomagnification.htm). It is important for biologists to determine if the severity of the symptoms of PCB poisoning are independent of their trophic level or not. Effects of PCB have been simplified into no effect, no reproduction, and death. Using the following hypothetical data from the St. Lawrence River is there any interaction between symptoms and the trophic level of the individual in question?

	No effect	No reproduction	Death	Column Total
1st Trophic level	133	100	17	250
Top Predator	4	61	35	100
Row Totals	137	161	52	350