Structure of the lab report

1. Write-up
   a) Brief description of the exercise of ecological sampling
   b) The difference between samples and populations
   c) The utility of statistics in going from the sample to the population
   d) The expected results

2. Plot the distribution of fractional occurances of the number of florets per inflorescence for
   a) Purple-top
   b) Purple-side
   c) White-top
   d) White-side

   and comment on their similarity or otherwise
   Plot all the 4 curves on the same plot for comparison while marking their identity in some way (e.g. colour code the lines, or use different kinds of lines: solid, dashed, dotted etc)

3. Test for the equality of population means for the above 4 categories

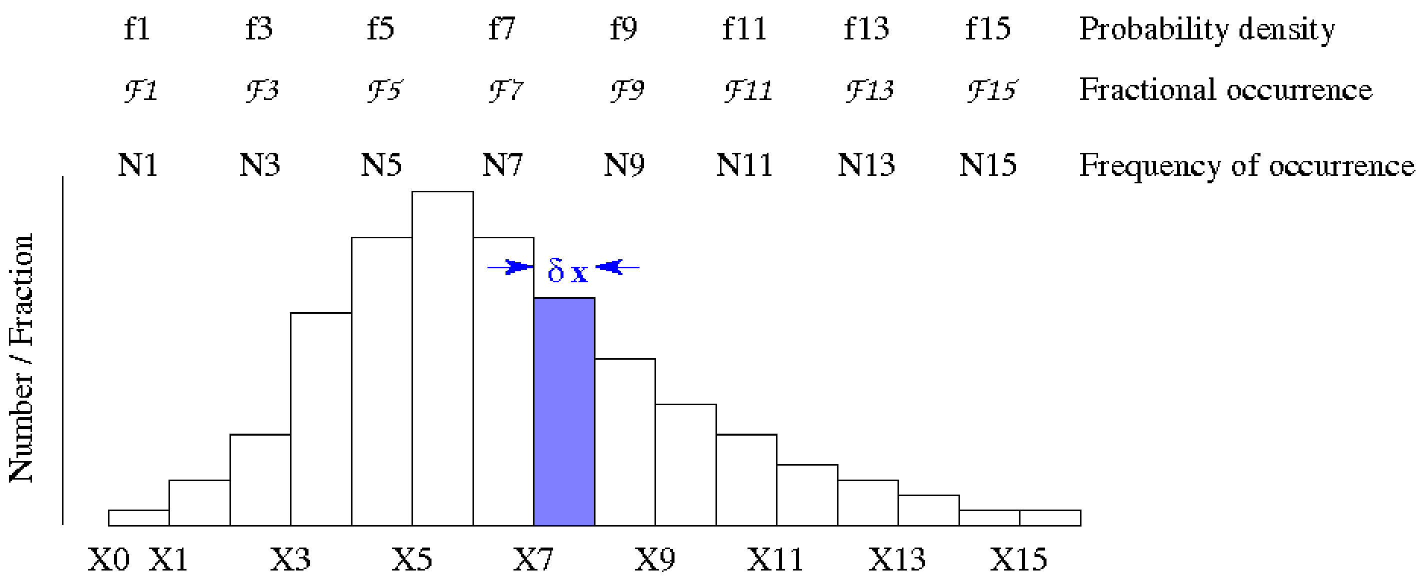
4. Plot the distribution of fractional occurances of the number of inflorences per grid and check if they can be Poisson distributions, for
   a) Top grids
   b) Side grids

   Overplot the corresponding Poisson (i.e. with the same mean value) on each distribution and comment on the differences if any.

5. Any other comments

(Discrete) Probability Distribution Functions

Specifies the relative frequency of occurrence of different values of a variable. Defines the "***Shape***"



x_i : is the value of the i-th bin

N_i : is the number of values in the i-th bin;

Total number : $N = \Sigma N_i$

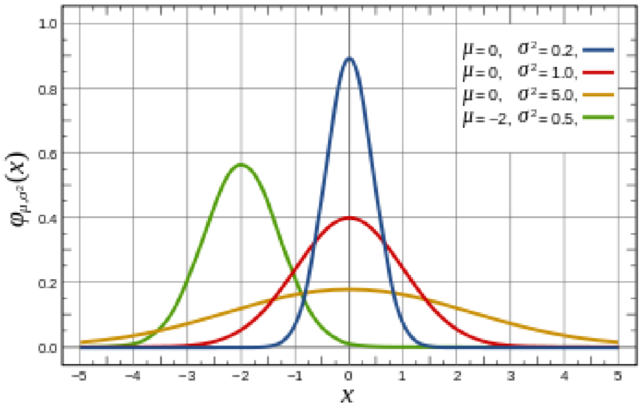
Fractional occurrence in the i-th bin: $F_i = N_i / N$

mean of X: $\langle x \rangle = \mu = \Sigma F_i . x_i$

mean of X^2: $\langle x^2 \rangle = \Sigma F_i . x_i^2$

Std devn of X: $\sigma = \mathrm{sqrt}(\langle x^2 \rangle - \langle x \rangle^2)$

Normal / Gaussian:



Widely used (and occasionally abused) in statistical analysis

Two parameters: **μ** and **σ** which correspond to the mean and standard deviation of the distribution.

Probability density function

$$f\left(x\right) \quad = \quad \frac{1}{\sigma\sqrt{2\pi}}\; e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Poisson Distribution

If an event occurs at some average rate, and is independent of the previous occurrence of the same, then the probability of the number of times the event occurs in a fixed time interval is given by the Poisson Distribution.

If the rate of occurrence of the event is R per unit time, and the interval of interest is T, the mean number of occurrence of the event is λ = RT

Distribution Function

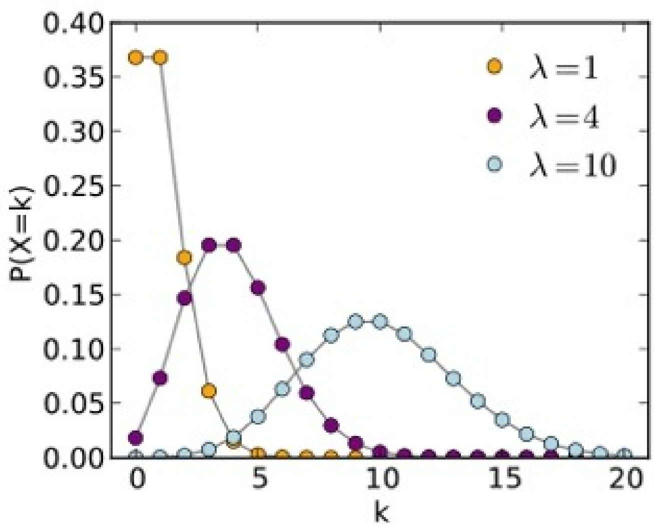
$$f\left(k;\lambda\right) \quad = \quad \frac{\lambda^k e^{-\lambda}}{k!}$$

Mean = Variance = **λ**

Poisson distribution is most often used to derive the error bars for counting statistics

Expected count of random numbers within a specified range for a gaussian distribution and the simulated values

Poisson can be replaced by a normal distribution for λ > 10 along with a continuity correction ... a correction for integer values



T-test : to test the equality of the population means from their sample values

Sample1: x_{1i} corresponding to population X_1

Sample1: x_{2j} corresponding to population X_2

Sample mean:	μ_{S1} μ_{S2}	
Std. Devn:	σ_{S1} σ_{S2}	
Sample size:	$N_1 = \Sigma N_{1i}$	$N_2 = \Sigma N_{2i}$

a. Calculate the t-statistic value

$$t = \frac{\mu_{S1} - \mu_{S2}}{\sqrt{\frac{(N_1-1)\sigma_{S1}^2 + (N_2-1)\sigma_{S2}^2}{N_1+N_2-2}} \sqrt{\frac{1}{N_1} + \frac{1}{N_2}}}$$

b. Calculate the degrees of freedom $dF = N_1 + N_2 - 1$

c. Calculate the p-value (column value in the green row in the table below) for the corresponding

1. degree of freedom (grey, first, column) : use Infinity if the value is > 100
2. t-statistic: body of the table
   (e.g. for dF = 15, if t = 1.753, p = 0.10; if t = 3.0, p < 0.01)

d. If the p-value is < 0.05 then the two means are from different populations, else we cannot say if they are from different populations

$P(\lvert t\rvert > t_0)$	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001	2-tail
∞	**0.674**	**0.842**	**1.036**	**1.282**	**1.645**	**1.960**	**2.326**	**2.576**	**3.090**	**3.291**	**T = Z**
1	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.3	636.6	
2	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.33	31.60	
3	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.22	12.92	
4	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610	
5	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869	
6	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959	
7	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408	
8	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041	
9	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781	
10	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587	
15	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073	
20	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850	
25	0.684	0.856	1.058	1.316	1.708	2.06	2.485	2.787	3.45	3.725	
30	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646	
100	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390	
Deg-Freedom											