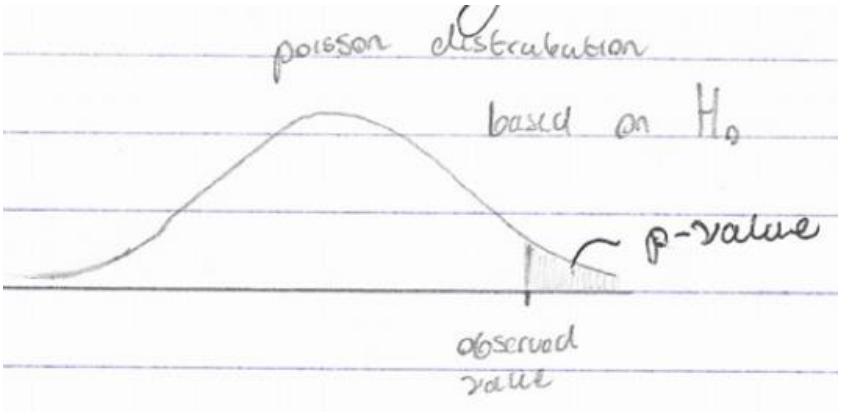
SB & SC - Poisson distribution & Type I/II errors

How can 2 Poisson Distributions be combined?	**Key point** If X and Y are two independent random variables that can be modelled using the Poisson distribution with distributions given by $X \sim \text{Po}(\lambda_x)$ and $Y \sim \text{Po}(\lambda_y)$, then $X + Y \sim \text{Po}(\lambda_x + \lambda_x)$ *This leads to result that m x X = Po(m x λ) where m is a positive rational number.*
What 4 conditions are needed for something to follow a Poisson distribution?	• Events occur at a constant average rate. • Events occur randomly and independently. • There can only be a discrete number of events. • Events occur singly. *Events occurring singly means that the probability of two events occurring in the same narrow interval is negligible.* *Furthermore, independent and random would mean no queues present (eg, cars on a motorway must be able to overtake freely and calls to a switch board must be dealt with instantly / no queuing).*
What is equal to the mean under Poisson?	Mean (λ) = median = mode = variance. *λ is average rate of occurrence in a given interval (eg, average number of events an hour).*
What is H_0 and H_1?	• H_0 - null hypothesis. • H_1 - alternative hypothesis (what you're testing for).
What is the p-value?	The probability of getting ≥ or ≤ a value given the null hypothesis is true (in other words, the probability of the data is at least as extreme as observed).

<table>
<tr><td></td><td> 
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<tr><td>What does the central limit theorem state?</td><td>The distribution of your sample means tends to the normal distribution (yet with a lower standard deviation than the population) as the sample size increases.</td></tr>
<tr><td>How is the evidence against H_0 measured?</td><td>● By using the p-value.
● The smaller it is, the greater the evidence UNTIL it's smaller than the significance value at which you reject H_0.

The greater the sample size, the more power the p-value has.</td></tr>
<tr><td>What a Type I and Type II error?</td><td>● Type I - rejecting H_0 when in fact it is true (false positive)
● Type II - failing to reject H_0 when it is in fact false (false negative)

<table>
<tr><th rowspan="2">Outcomes</th><th colspan="2">Underlying truth</th></tr>
<tr><th>H_0 false</th><th>H_0 true</th></tr>
<tr><td>Reject H_0</td><td>Correct</td><td>Type I error</td></tr>
<tr><td>Don't reject H_0</td><td>Type II error</td><td>Correct</td></tr>
</table></td></tr>
<tr><td>What is P(Type I Error) equal to in the case of continuous and the case of discrete?</td><td>● Continuous - α (the significance value).
● Discrete - the probability of something occur just below the significance value.

Reducing the value does increase the chances of a Type II error so you need a balance.</td></tr>
<tr><td>What is the power of a test?</td><td>1 - P(Type II Error).</td></tr>
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	This is, obviously, the probability of not making a Type II error.
How can you find the P(Type II Error)?	1. Find the critical values. 2. Find the probability of accepting H_0 (lying in the critical values) under the actual mean.