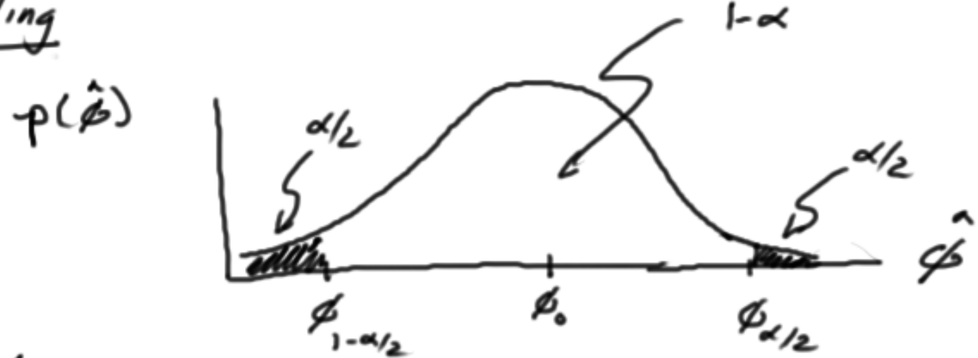
Hypothesis Testing



Hypothesis Test

"Null Hypothesis" $H_0: \phi = \phi_0$

"Alternate Hypothesis" $H_A: \phi \neq \phi_0$ 2 sided test

Is there sufficient evidence in the data to reject the null hypothesis?
(you <u>cannot</u> accept the null hypothesis, you just can't reject it)

The probability that you will reject the null hypothesis when in fact it is true is α which also is called the level of significance of the test

Runs Test

If a sequence of N observations are independent observations of the same random variable (i.e. probability of a "+" or a "−" result does not change from one observation to another), then the sampling distribution of the number of runs in the sequence is a random variable r with mean and variance

$$\mu_r = \frac{2N_1N_2}{N} + 1$$

$$\sigma_r^2 = \frac{2N_1N_2(2N_1N_2 - N)}{N^2(N-1)}$$

N_1 is # of +'s
N_2 is # of −'s
$N = N_1 + N_2$

For the special case when $N_1 = N_2 = N/2$

$$\mu_r = \frac{N}{2} + 1$$

$$\sigma_r^2 = \frac{N(N-2)}{4(N-1)}$$

$n = \frac{N}{2}$

MARINE PHYSICAL LABORATORY

Statistical Analysis of Time Series

HW Assignment – Runs Test

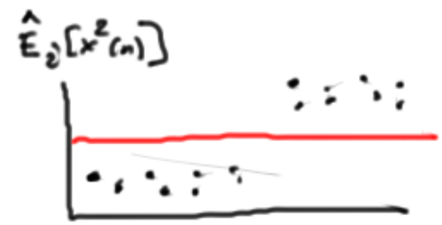
$$\hat{E}_i[x^2(n)] = \frac{1}{10}\sum_{m=0}^{9} x^2(m+10i)$$

$i = 0, 1, \ldots, 99$

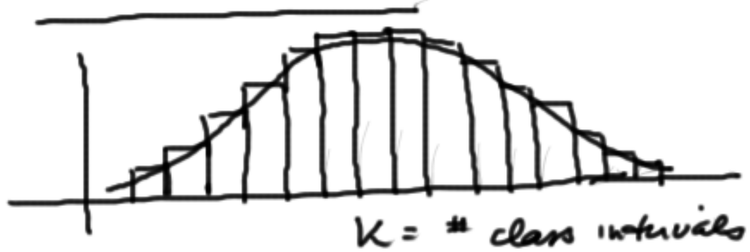
thus, $\hat{E}_i[x^2(n)]$ is a sequence of 100 "local" power estimates

In above, there are r = 11 runs

Time series A4 - variance changes half way through sequence



Goodness of Fit



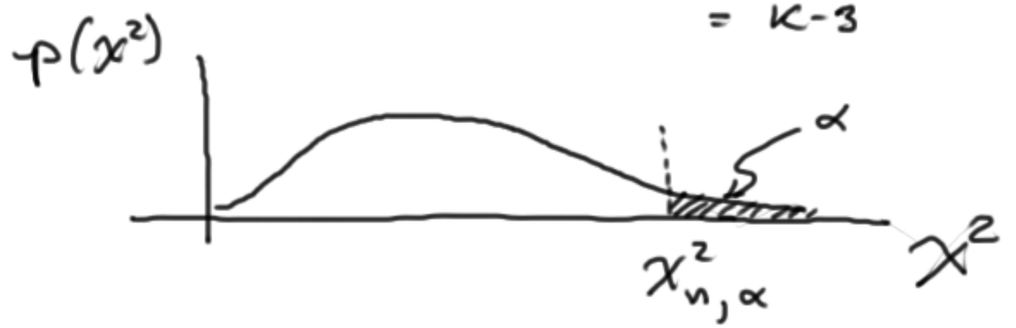
Chi-Square Goodness of Fit

$$\chi^2 = \sum_{i=1}^{K} \frac{(f_i - F_i)^2}{F_i}$$

f_i = observed frequency or # obs

F_i = predicted frequency or # obs

n = # degrees of freedom = $K - 3$

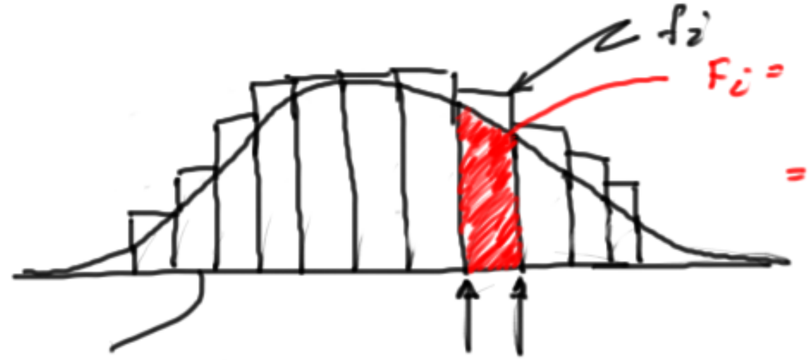


Select class intervals such that the expected frequency F_i in each interval is equal – then min number of class intervals for $\alpha = 0.05$ should be

N	200	400	600	800	1000	1500	2000
K	16	20	24	27	30	35	39

HW #6

Statistical Analysis of Time Series



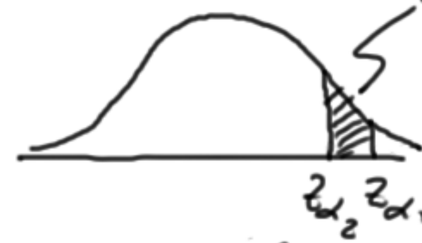
$F_i = $ (area under Gaussian pdf)(total # obs)

= predicted frequency or # obs

Test statistic $\chi^2 = \sum_{i=1}^{k} \frac{(f_i - F_i)^2}{F_i}$

Standardized normal $p(z)$

See Table A.2



Example 4.3 - note that class interval boundaries are not equal increments

- they are determined such that class intervals have equal areas

Mapping from z_α into observation space

$$X_\alpha = S\, z_\alpha + \bar{x}$$

provides interval boundaries in observation space