CIVL - 7904/8904

TRAFFIC FLOW THEORY

LECTURE -6

Other Approaches

- Schuhl's model
- Two classes of vehicles
  - Constrained vehicles
  - Free-moving vehicles
- Constrained vehicles:
  - Shifted negative exponential distribution
- Free flowing vehicles
  - Negative exponential distribution

$$P(h \geq t) = Pe^{-(t-\alpha)/(\bar{t}-\alpha)} + (1-P)\, e^{-t/\bar{t}}$$

Evaluating and Selecting Distributions

- From all the methods we discussed some appear to represent the measured distributions well and some does not.
- We need to evaluate them
  - Qualitatively, and
  - Quantitatively
- Two statistical techniques are used
  - Chi-square
  - Kolmogorov-Smirnov

Evaluation

- These tests can be used to evaluate how well a measured distribution can be represented by a mathematical distribution.
- There always lies risk of error based on the hypothesis

Hypothesis

- Accept Hypothesis
  - “There is no evidence of a statistical difference between the two distributions and the measured distribution could be identical to the mathematical distribution”
- Reject Hypothesis
  - “There is evidence of a statistical difference between the two distributions and it is unlikely that the measured distribution is identical to the mathematical distribution”

Possible Outcomes

		Truth Situation	
		Two Distributions Identical	Two Distributions Different
Predicted Situation	No evidence of difference (Accept Hypothesis)	√	Type-II error
	Evidence of difference (Reject Hypothesis)	Type-I Error	√

Error

- Type – I error
  - When prediction shows that the two distributions are different, but in truth situation two distributions are identical
- Type-II error
  - When prediction shows that two distributions are identical but in truth situation two distributions are different

Chi-square Test

$$\chi^2_{calc} = \sum_{i=1}^{I} \frac{(f_0 - f_t)^2}{f_t}$$

where.,

χ^2_{calc} -> Calculated chi-square value

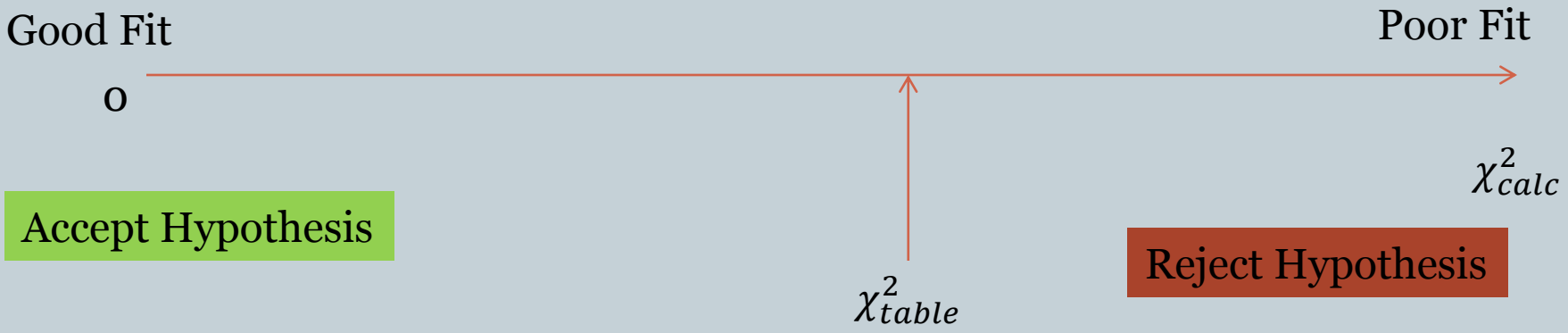
f_0-> Observed number or frequency of observations in time headway interval i

f_t-> Theoretical number or frequency of observations in time headway interval I

i-> Any time headway interval

I-> Number of time headway intervals

Accept or Reject Hypothesis



$\chi^2_{table} > \chi^2_{calc}$ Accept
Otherwise Reject

How to find Chi-square (Table)

$$n=(I-1)-p$$

Where,

- n -> Number of degrees of freedom
- I -> Number of time headway intervals being compared
- 1 = constant
- p= Number of parameters estimated in defining the mathematical distribution

Why 1 is subtracted

- A constant “1” is subtracted from the number of time headway groups since the total frequency of the two distributions are set equal
- Therefore, the theoretical frequency of the last group is not dependent on I-1 frequencies

Number of parameters needed

Distribution	Parameters (p)
Measured	0
Negative Exponential	1 $(\overline{t})$
Shifted Negative Exponential	2 $(\overline{t}, \alpha)$
Normal	2 $(\overline{t}, s)$
Pearson Type-III	2 (K, λ)
Composite	4

Derive Chi-square