



# ASQ CRE Prep course

Lesson II. A. 4. e.

Poisson Process Models

Laplace's Trend Test

A wide-angle photograph of a coastal landscape. The foreground is filled with the calm, light blue-green waters of a sea or lake. In the middle ground, a range of mountains with snow-capped peaks stretches across the horizon under a clear, pale blue sky. The overall scene is serene and expansive.

Another trend test

# LAPLACE'S TREND TEST

# Step 1: Set Period of Observation

- **Set T the period of interest**
- **Either at time of last failure**
  - Drop last failure and
  - Reduce n by one
- **Or, a duration of interest, say one year**

# Step 2: Gather arrival times

- **Test uses cumulative times, not interarrival times**
- Let's use the example of:  
**36, 63, 86, 128, 165, 324**

**are days on which repairs occur  
and repairs take about an hour**

# Step 3: Calculate test statistic

- **The test statistic z is**
  - T is selected duration
  - t-bar is the mean of cumulative time to failure data

$$z = \left( \frac{2\bar{t}}{T} - 1 \right) \sqrt{3n}$$

$$\bar{t} = \frac{\sum t_i}{n} = \frac{802}{6} = 133.67$$

- **Let's set T = 365 days, and**
- **Thus**  $z = \left( \frac{2\bar{t}}{T} - 1 \right) \sqrt{3n} = \left( \frac{2(133.67)}{365} - 1 \right) \sqrt{3(6)} = -1.135$

# Step 5: Compare z-value & critical value

- The critical value for  $\alpha = 0.05$  for this two sided test is  $\pm 1.96$
- Since  $-1.13$  is within the range of  $\pm 1.96$  the data does not show convincing evidence of a trend
- Extreme negative values show improving reliability, extreme positive values show degradation

Why would you  
want to know  
the trend?



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Poisson Process Models

Fisher's Composite Test