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Data Analysis Formulas

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List of 15 Data Analysis Formulas

Data Analysis

1) Actual S by N Ratio at Output

Open Calculator

fx $$\mathrm{SN_{out}} = \frac{\mathrm{SN_m}}{\mathrm{F}}$$

ex $$30\mathrm{dB} = \frac{390\mathrm{dB}}{13\mathrm{dB}}$$

2) Average Duration of Fade

Open Calculator

fx $$\mathrm{n_R} = \frac{\mathrm{CDF}}{\mathrm{t_{avg}}}$$

ex $$11 = \frac{38.5}{3.5\mathrm{s}}$$

3) Capability of Error Correction Bits

Open Calculator

fx $$\mathrm{t} = \frac{\mathrm{d} - 1}{2}$$

ex $$7 = \frac{15 - 1}{2}$$

4) Coding Noise

Open Calculator

fx $$CN = \frac{I_W^2}{SNR}$$

ex $$6.25\text{dB} = \frac{(25\text{V})^2}{100\text{dB}}$$

5) Expected Number of Transmission

Open Calculator

fx $$E_n = \frac{1}{(1 - P_{ew})^m}$$

ex $$3.99509 = \frac{1}{(1 - 0.697)^{1.16}}$$

6) Expected One Transmission(E1)

Open Calculator

fx $$E_1 = \frac{1}{1 - P_{ew}}$$

ex $$3.30033 = \frac{1}{1 - 0.697}$$

7) Header Bits

Open Calculator

fx $$H = B_{wd} - L$$

ex $$9 = 12 - 3$$

8) Information Bits

Open Calculator

$$L = B_{wd} - H$$

$$3 = 12 - 9$$

9) Input Waveform

Open Calculator

$$I_W = \sqrt{SNR \cdot CN}$$

$$25V = \sqrt{100dB \cdot 6.25dB}$$

10) Number of Bits Per Word

Open Calculator

$$m = \frac{\log 10\left(\frac{1}{E_n}\right)}{\log 10(1 - P_{ew})}$$

$$1.161029 = \frac{\log 10\left(\frac{1}{4}\right)}{\log 10(1 - 0.697)}$$

11) Success Probability

Open Calculator

$$P_s = \frac{P_u \cdot (1 - P_{um})}{P_{um}}$$

$$0.3 = \frac{0.2 \cdot (1 - 0.4)}{0.4}$$

12) Undetected Error Probability per Single-Word Message

Open Calculator

fx $$P_{um} = \frac{P_u}{P_u + P_s}$$

ex $$0.4 = \frac{0.2}{0.2 + 0.3}$$

13) Undetected Probability per Word

Open Calculator

fx $$P_u = \frac{P_{um} \cdot P_s}{1 - P_{um}}$$

ex $$0.2 = \frac{0.4 \cdot 0.3}{1 - 0.4}$$

14) Unsuccess Probability

Open Calculator

fx $$P_{ew} = 1 - P_s$$

ex $$0.7 = 1 - 0.3$$

15) Word Error Rate

Open Calculator

fx $$P_{ew} = 1 - \left(\frac{1}{E_n}\right)^{\frac{1}{m}}$$

ex $$0.697321 = 1 - \left(\frac{1}{4}\right)^{\frac{1}{1.16}}$$

Variables Used

- B_{wd} Number of Bits per Word
- **CDF** Cumulative Distribution Function
- **CN** Coding Noise *(Decibel)*
- **d** Hamming Distance
- E_1 Expected One Transmission
- E_n Expected Number of Transmission
- **F** Noise Figure of Amplifier *(Decibel)*
- **H** Header Bits
- I_W Input Waveform *(Volt)*
- **L** Information Bits
- **m** Message Length
- n_R Normalized LCR
- P_{ew} Word Error Rate
- P_s Success Probability
- P_u Undetected Probability
- P_{um} Undetected Error Probability
- SN_m Maximum Possible S/N Ratio *(Decibel)*
- SN_{out} Actual S/N Ratio at Output *(Decibel)*
- **SNR** Signal to Noise Ratio *(Decibel)*
- **t** Capability of Error Correction Bits
- t_{avg} Average Duration of Fade *(Second)*

Constants, Functions, Measurements used

- Function: **log10**, log10(Number)
  Common logarithm function (base 10)
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Noise** in Decibel (dB)
  Noise Unit Conversion
- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion
- Measurement: **Sound** in Decibel (dB)
  Sound Unit Conversion

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