Kirkup Chapter 1 Lecture Notes

SEF Workshop presentation = Science Fair Data Analysis_Sohl.pptx

EDA = Exploratory Data Analysis

Aim of an Experiment = Experiments should have a goal. Make note of interesting issues for later. Be careful not to get side-tracked.

Designing an Experiment = Put effort where it makes sense, do preliminary fractional error analysis to determine where you need to improve.

Units analysis and equation checking
Units website

Writing down values: scientific notation and SI prefixes

http://en.wikipedia.org/wiki/Metric_prefix

Significant Figures

Histograms in Excel

Bin size – reasonable round numbers 15-16 not 14.8-16.1

Bin size – reasonable quantity: Rule of Thumb = # bins = $N \approx \sqrt{n}$ where *n* is the number of data points.

Basic Statistics

range, mean, median, mode, variance, standard deviation

Population, Sample

Cool trick for small sample sizes. Estimate $s \approx \frac{\text{range}}{\sqrt{n}}$ this works for n<12 or so.

Random Error vs. Systematic Error

Metric prefixes

Prefix	Symbo	1000^m	10^n	Decimal	Short scale	Long scal	Since[n 1]
yotta	Y	1000^8	10^{24}	1000000000000000000000000	septillion	quadrillion	1991
zetta	Z	1000^7	10^{21}	1000000000000000000000	sextillion	trilliard	1991
exa	E	1000^6	10^{18}	1000000000000000000	quintillion	trillion	1975
peta	P	1000^5	10^{15}	1000000000000000	quadrillion	billiard	1975
tera	T	1000^4	10^{12}	1000000000000	trillion	billion	1960
giga	G	1000^3	10^9	1000000000	billion	milliard	1960
mega	M	1000^2	10^6	1000000	million		1960
kilo	k	1000^1	10^3	1000	thousand		1795
hecto	h	$1000^{2/3}$	10^2	100	hundred		1795
deca	da	$1000^{1/3}$	10^1	10	ten		1795
		1000^0	10^0	1	one		–
deci	d	$1000^{-1/3}$	10^{-1}	0.1	tenth		1795
centi	c	$1000^{-2/3}$	10^{-2}	0.01	hundredth		1795
milli	m	1000^{-1}	10^{-3}	0.001	thousandth		1795
micro	µ	1000^{-2}	10^{-6}	0.000001	millionth		1960
nano	n	1000^{-3}	10^{-9}	0.000000001	billionth	milliardth	1960
pico	p	1000^{-4}	10^{-12}	0.000000000001	trillionth	billionth	1960
femto	f	1000^{-5}	10^{-15}	0.000000000000001	quadrillionth	billiardth	1964
atto	a	1000^{-6}	10^{-18}	0.000000000000000001	quintillionth	trillionth	1964
zepto	z	1000^{-7}	10^{-21}	0.000000000000000000001	sextillionth	trilliardth	1991
yocto	y	1000^{-8}	10^{-24}	0.000000000000000000000001	septillionth	quadrillionth	1991

1. ^ The metric system was introduced in 1795 with six prefixes. The other dates relate to recognition by a resolution of the CGPM.

SI Prefixes List

Prefix	Symbol	10^n	Long/Short Scale
yotta (gr. *okto* - eight)	Y	10^{24}	Quadrillion/Septillion
zetta (lat. *septem* - seven)	Z	10^{21}	Trilliard/Sextillion
eksa (gr. *ex* - six)	E	10^{18}	Trillion/Quintillion
peta (gr. *penta* - five)	P	10^{15}	Billiard/Quadrillion
tera (gr. *teras* – monster)	T	10^{12}	Billion/Trillion
giga (gr. *gigas* – giant)	G	10^9	Milliard/Billion
mega (gr. *megas* – great)	M	10^6	Million/Million
kilo (gr. *khilioi* – thousand)	k	10^3	Thousand/Thousand
hecto (gr. *hekaton* – hundred)	h	10^2	Hundred/Hundred
deca (gr. *deka* – ten)	da	10^1	Ten/Ten
		10^0	One/One

decy (lat. *decimus* – tenth)	d	10^{-1}	Tenth/Tenth
centy (lac. *centum* – hundredth)	c	10^{-2}	Hundredth/Hundredth
milli (lac. *mille* – thousand)	m	10^{-3}	Thousandth/Thousandth
mikro (gr. *mikros* – small)	μ	10^{-6}	Millionth/Millionth
nano (gr. *nanos* – dwarf)	n	10^{-9}	Milliardth/Billionth
pico (it. *piccolo* – small)	p	10^{-12}	Billionth/Trillionth
femto (den. *femten* – fifteen)	f	10^{-15}	Billiardth/Quadrillionth
atto (den. *atten* – eighteen)	a	10^{-18}	Trillionth/Quintillionth
zepto (lat. *septem* - seven)	z	10^{-21}	Trilliardth/Sextillionth
yokto (gr. *okto* - eight)	y	10^{-24}	Quadrillionth/Septillionth

From: http://www.mansfieldschools.com/mhs/physics/Physics%20Humor/Humor.htm

10^{1} cards

10^{6} phone

10^{-6} scope

10^{-6} phone

10^{-2} pede

10^{-3} pede

10^{9} ly (two pronunciations)

10^{12} bull

10^{-9} 10^{-9} (said by what person on what old television show)

2×10^{3} mockingbird

2×10^{2} with it

10^{-3} Vanilli

10^{-1} mate

10^{-12} bo St. (Chap Stick personality)

10^{2} grade

10^{21} Marx

10^{-18} boy

10^{9} lo

10^{12} firma

10^{15} bull

10^{18} m

10^{6} bucks

10^{3} what

serial 10^{3}

10^{6} lo maniac

10^{1} dent

10^{-3} tary

10^{9} goat

10^{18} tude

10^{-1} and Lucy

10^{-21} , Harpo, Chico and Groucho

10^{24} -see me now

10^{18} terrestrial

10^{15} , Paul and Mary

10^{18} -lent

10^{12} -tory

10^{-12} -lo