Homework 6

(1)

- **A. present, browse, identify, extremes**
- **B. present, browse, compare, features and extremes**
- **C. discover, explore, compare, trends and similarity**
- **D. enjoy, explore, summarize, topology and shape**

(2)

- **A. f(x) = x^3**

x = {0, 1, 2, 3, 4}
f(x) = x^3
x' = map(v => f(v))

x:
mean = (0 + 1 + 2 + 3 + 4) / 5 = 2
f(mean) = f(2) = 8

x':
x' = {0, 1, 8, 27, 64}
mean = (0 + 1 + 8 + 27 + 64) / 5 = 100 / 5 = 20

f(mean) != mean of x'
8 != 20

Therefore, f(x) = x^3 does NOT commute with finding the mean

B. **Hallucinator (ordinal data limits permissible statistics)**
C. **f(x) = 2x + 5**

x = {0, 1, 2, 3, 4}
f(x) = 2x - 3
x’ = map(x => f(v))

x:
mean = (0, 1, 2, 3, 4) / 5 = 2
stdev = sqrt(((0 – mean)^2 +…+ (4 – mean)^2)) / 5)
= (-2)^2 + (-1)^2 + (0)^2 + (1)^2 + (2)^2 = 10/5 = 2
= sqrt(2) = 1.414
coeff = mean / stdev = 2 / 1.414 = 1.414

x’:
x’ = {-3, -1, 1, 3, 5}
mean = (-3 - 1 + 1 + 3 + 5) / 5 = 1
stdev = sqrt(((-3 - mean)^2 +…+ (5 - mean)^2)) / 5)
= (-4)^2 + (-2)^2 + (0)^2 + (2)^2 + (4)^2 / 5 = 40 / 5 = 8
= sqrt(8) = 2.828
coeff = mean / stdev = 1 / 2.828 = 0.356

1.414 != 0.356

D. **Symmetry, monotonic transformations**
E. **There is an ambiguity because Fig 1.25 maps non-interval or ratio values to the bar graph’s length (matching visual symmetry is unsatisfactory to viewer)**
F. **If these 4 equiluminant hues (ordinal values) have an intrinsic order, then it would cause permutation misleaders, as they do not have a natural perceptual ordering by viewers.**

(3)

A. 1/n * summation(1 to n) of X_T * X

B. M_ii is the variance of each dimension (i.e. M_11 = cov(x, x) = var(x), M_22 = cov(y, y) = var(y)). No variance can be smaller than 0. The variance is measured by the deviation from the mean of each number in a dataset. If every number is the same the variance can be only as small as 0.

C. We'll get n – 1 non-zero eigenvalues with noise around zero if only alpha. Thus you get a well defined solution.

D. Data is defined on e1…e6 where e is an array of eigenvectors, and if first 2 eigenvalues on the diagonals are larger, than we can project the data on the two dimensions, otherwise we aren't going to learn that much.