

## BIOE 440 - Homework #2

1. Consider the data shown in Exercise 2.5.5 (p. 53). Calculate the following measures of central tendency and dispersion. Show your work (i.e., don't use Excel or a special function button on your calculator).
  - a. arithmetic mean, median and mode
  - b. variance, standard deviation, coefficient of variation
  
2. Exercise 16 (p. 58). Answer (a), (b) and (c). What measure of central tendency do you think is most appropriate for the Cystatin data? Justify your choice.

artery. Another important variable measured was the heart rate (bpm) during the withdrawal of blood. The table below presents the heart rate of seven rat pups from the experiment involving the carotid artery.

500	570	560	570	450	560	570
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Source: Harry N. Shair and Anna Jasper, "Decreased Venous Return Is Neither Sufficient nor Necessary to Elicit Ultrasonic Vocalization of Infant Rat Pups," *Behavioral Neuroscience*, 117 (2003), 840-853.

- 2.5.3 Butz et al. (A-10) evaluated the duration of benefit derived from the use of noninvasive positive-pressure ventilation by patients with amyotrophic lateral sclerosis on symptoms, quality of life, and survival. One of the variables of interest is partial pressure of arterial carbon dioxide ( $\text{PaCO}_2$ ). The values below (mm Hg) reflect the result of baseline testing on 30 subjects as established by arterial blood gas analyses.

40.0	47.0	34.0	42.0	54.0	48.0	53.6	56.9	58.0	45.0
54.5	54.0	43.0	44.3	53.9	41.8	33.0	43.1	52.4	37.9
34.5	40.1	33.0	59.9	62.6	54.1	45.7	40.6	56.6	59.0

Source: M. Butz, K. H. Wollinsky, U. Widemuth-Catrinescu, A. Sperfeld, S. Winter, H. H. Mehrkens, A. C. Ludolph, and H. Schreiber, "Longitudinal Effects of Noninvasive Positive-Pressure Ventilation in Patients with Amyotrophic Lateral Sclerosis," *American Journal of Medical Rehabilitation*, 82 (2003), 597-604.

- 2.5.4 According to Starch et al. (A-11), hamstring tendon grafts have been the "weak link" in anterior cruciate ligament reconstruction. In a controlled laboratory study, they compared two techniques for reconstruction: either an interference screw or a central sleeve and screw on the tibial side. For eight cadaveric knees, the measurements below represent the required force (in newtons) at which initial failure of graft strands occurred for the central sleeve and screw technique.

172.5	216.63	212.62	98.97	66.95	239.76	19.57	195.72
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Source: David W. Starch, Jerry W. Alexander, Philip C. Noble, Suraj Reddy, and David M. Lintner, "Multistranded Hamstring Tendon Graft Fixation with a Central Four-Quadrant or a Standard Tibial Interference Screw for Anterior Cruciate Ligament Reconstruction," *American Journal of Sports Medicine*, 31 (2003), 338-344.

- 2.5.5 Cardosi et al. (A-12) performed a 4-year retrospective review of 102 women undergoing radical hysterectomy for cervical or endometrial cancer. Catheter-associated urinary tract infection was observed in 12 of the subjects. Below are the numbers of postoperative days until diagnosis of the infection for each subject experiencing an infection.

16	10	49	15	6	15
8	19	11	22	13	17

Source: Richard J. Cardosi, Rosemary Cardosi, Edward C. Grendys Jr., James V. Fiorica, and Mitchel S. Hoffman, "Infectious Urinary Tract Morbidity with Prolonged Bladder Catheterization After Radical Hysterectomy," *American Journal of Obstetrics and Gynecology*, 189 (2003), 380-384.

- 2.5.6 The purpose of a study by Nozawa et al. (A-13) was to evaluate the outcome of surgical repair of a pars interarticularis defect by segmental wire fixation in young adults with lumbar spondylolysis. The authors found that segmental wire fixation historically has been successful in the

- (a) Construct a stem-and-leaf plot for these gestational ages.  
 (b) Based on the stem-and-leaf plot, what one word would you use to describe the nature of the data?  
 (c) Why do you think the stem-and-leaf plot looks the way it does?  
 (d) Compute the mean, median, variance, and standard deviation.
14. The following table gives the age distribution for the number of deaths in New York State due to accidents for residents age 25 and older.

Age (Years)	Number of Deaths Due to Accidents
25-34	393
35-44	514
45-54	460
55-64	341
65-74	365
75-84	616
85-94*	618

Source: New York State Department of Health, Vital Statistics of New York State, 2000, Table 32: *Death Summary Information by Age*.

\*May include deaths due to accident for adults over age 94.

For these data construct a cumulative frequency distribution, a relative frequency distribution, and a cumulative relative frequency distribution.

15. Krieser et al. (A-17) examined glomerular filtration rate (GFR) in pediatric renal transplant recipients. GFR is an important parameter of renal function assessed in renal transplant recipients. The following are measurements from 19 subjects of GFR measured with diethylenetriamine pentaacetic acid. (Note: some subjects were measured more than once.)

18 42  
 21 43  
 21 43  
 23 48  
 27 48  
 27 51  
 30 55  
 32 58  
 32 60  
 32 62  
 36 67  
 37 68  
 41 88  
 42 63

Source: D. M. Z. Krieser, M.D. Used with permission.

- (a) Compute mean, median, variance, standard deviation, and coefficient of variation.  
 (b) Construct a stem-and-leaf display.  
 (c) Construct a box-and-whisker plot.  
 (d) What percentage of the measurements is within one standard deviation of the mean? Two standard deviations? Three standard deviations?
16. The following are the cystatin C levels (mg/L) for the patients described in Exercise 15 (A-17). Cystatin C is a cationic basic protein that was investigated for its relationship to GFR levels. In

addition, creatinine levels are also given. (Note: Some subjects were measured more than once.)

Cystatin C (mg/L)		Creatinine (mmol/L)	
1.78	4.69	0.35	0.14
2.16	3.78	0.30	0.11
1.82	2.24	0.20	0.09
1.86	4.93	0.17	0.12
1.75	2.71	0.15	0.07
1.83	1.76	0.13	0.12
2.49	2.62	0.14	0.11
1.69	2.61	0.12	0.07
1.85	3.65	0.24	0.10
1.76	2.36	0.16	0.13
1.25	3.25	0.17	0.09
1.50	2.01	0.11	0.12
2.06	2.51	0.12	0.06
2.34			

Source: D. M. Z. Krieser, M.D. Used with permission.

(a) For each variable, compute the mean, median, variance, standard deviation, and coefficient of variation.

(b) For each variable, construct a stem-and-leaf display and a box-and-whisker plot.

(c) Which set of measurements is more variable, cystatin C or creatinine? On what do you base your answer?

17. Give three synonyms for variation (variability).

18. The following table shows the age distribution of live births in Albany County, New York, for 2000.

Mother's Age	Number of Live Births
10-14	7
15-19	258
20-24	585
25-29	841
30-34	981
35-39	526
40-44	99
45-49*	4

Source: New York State Department of Health, Annual Vital Statistics 2000, Table 7, *Live Births by Resident County and Mother's Age*.

\*May include live births to mothers over age 49.

For these data construct a cumulative frequency distribution, a relative frequency distribution, and a cumulative relative frequency distribution.