1) **(15 points) UC Enrollment.** According to the *Statistical Summary of Students and Staff*, prepared by the Department of Information Resources and Communications, Office of the President, University of California, the Fall 2012 enrollment figures for undergraduates at the University of California campuses were as follows.

Campus	Enrollment (1000s)
Berkeley	25.8
Davis	25.8
Irvine	22.1
Los Angeles	27.7
Merced	5.4
Riverside	18.6
San Dicgo	22.7
Santa Barbara	19.0
Santa Cruz	16.0

LA.

$z = \frac{\bar{x} - \mu}{\sigma} = \frac{27.7 - 20.36}{6.42}$

$z = 1.14$

Riverside

$z = \frac{18.6 - 20.36}{6.42} = -.27$

a) Compute the population mean enrollment, μ, of the UC campuses. (Round your answer to two decimal places.)

20,36

6.42

b) Compute σ. (Round your answer to two decimal places.)

c) Obtain and interpret the *z*-scores for the enrollments at the Los Angeles and Riverside campuses.

Table 4.16 **Adjusted gross incomes**

Adjusted gross income	Frequency (1000s)	Event	Probability
Under $10K	26,268	*A*	.184 =18.4%
$10K–under $20K	22,778	*B*	.160
$20K–under $30K	18,610	*C*	.131
$30K–under $40K	14,554	*D*	.102
$40K–under $50K	11,087	*E*	.078
$50K–under $100K	30,926	*F*	.217
$100K & over	18,227	*G*	.128
	142,450		

$H =$ event the return shows an AGI between \$20K and \$10

$I =$ event the reurn shows an AGI of less than \$50K ,

$J =$ event the return shows an AGI of less than \$100K, anc

$K =$ event the return shows an AGI of at least \$50K.

Adjusted gross income	Probability
Under \$10K	.184 =
\$10K–under \$20K	.160
\$20K–under \$30K	.131
\$30K–under \$40K	.102
\$40K–under \$50K	.078
\$50K–under \$100K	.217
\$100K & over	.128

(not J)

(H & I)

(H or K)

(H & K)

$H = 0{,}528$

$I = 0{,}655$

$J = 0{,}872$

$K = 0.345$

$H =$ event the return shows an AGI between \$20K and \$10

$I =$ event the reurn shows an AGI of less than \$50K ,

$J =$ event the return shows an AGI of less than \$100K, and

$K =$ event the return shows an AGI of at least \$50K.

Adjusted gross income	Probability
Under \$10K	.184 =
\$10K–under \$20K	.160
\$20K–under \$30K	.131
\$30K–under \$40K	.102
\$40K–under \$50K	.078
\$50K–under \$100K	.217
\$100K & over	.128

(not J) 0.128

(H & I) 0.311

(H or K)

(H & K)

H = 0.528

I = 0.655

J = 0.872

K = 0.345

$H =$ event the return shows an AGI between \$20K and \$10

$I =$ event the reurn shows an AGI of less than \$50K ,

$J =$ event the return shows an AGI of less than \$100K, and

$K =$ event the return shows an AGI of at least \$50K.

Adjusted gross income	Probability
Under \$10K	.184 =
\$10K–under \$20K	.160
\$20K–under \$30K	.131
\$30K–under \$40K	.102
\$40K–under \$50K	.078
\$50K–under \$100K	.217
\$100K & over	.128

H=0.528

I=0.655

J=0.872

K=0.345

(not J)

(H & I)

(H or K) 0.656

(H & K) 0.217

3) (10 points) Elephant Pregnancies. G. Wittemeyer et al. studied demographic data on African elephants living in Kenya in the article "Comparative Demography of an At-Risk African Elephant Population" (*PLOS ONE*, Vol. 8. No. 1). Based on this study, we will assume that the time between pregnancies of the African elephant in Kenya, for elephants that have more than one calf, is normally distributed with mean 4.01 years and standard deviation 0.94 years. Determine the percentage of such times that are

a) less than 2 years.
b) between 3 and 5 years.

a) $z = \dfrac{2-4.01}{0.94} = -2.14$

$.01618 \approx 1.618\%$

b) $z = \dfrac{3-4.01}{0.94} = -1.07$

$z = \dfrac{5-4.01}{0.94} = 1.05$

1.05 $\quad -1.07$

$.85314 - .14231$

$.7108 = 71.08\%$

4) **(20 points) Income Tax and the IRS.** In 2010, the Internal Revenue Service (IRS) sampled 308,946 tax returns to obtain estimates of various parameters. Data were published in *Statistics of Income, Individual Income Tax Returns*. According to that document, the mean income tax per return for the returns sampled was $11,266.

a) Explain the meaning of sampling error in this context.
b) If, in reality, the population mean income tax per return in 2010 was $11,354, how much sampling error was made in estimating that parameter by the sample mean of $11,266? $88
c) If the IRS had sampled 400,000 returns instead of 308,946, would the sampling error necessarily have been smaller? Explain your answer.
d) In future surveys, how can the IRS increase the likelihood of small sampling error?

5) **(10 points) Venture-Capital Investments**. Data on investments in the high-tech industry by venture capitalists are compiled by VentureOne Corporation and published in *America's Network Telecom Investor Supplement*. A random sample of 18 venture-capital investments in the fiber optics business sector yielded the following data, in millions of dollars.

Determine and interpret a 95% confidence interval for the mean amount, μ, of all venture-capital investments in the fiber optics business sector. Assume that the population standard deviation is \$2.04 million. (*Note:* The sum of the data is \$113.97 million.)

$$\mu = \frac{113.97}{18} = 6.33 \qquad 95\% \quad z_{0.025} = 1.96$$

$$6.33 \pm 1.96\left(\frac{2.04}{\sqrt{18}}\right)$$

$$5.39 \longleftrightarrow 7.27$$

6) **(10 points) Children of Diabetic Mothers**. The paper "Correlations between the Intrauterine Metabolic Environment and Blood Pressure in Adolescent Offspring of Diabetic Mothers" (*Journal of Pediatrics*, Vol. 136, Issue 5, pp. 587–592) by N. Cho et al. presented findings of research on children of diabetic mothers. Past studies showed that maternal diabetes results in obesity, blood pressure, and glucose tolerance complications in the offspring. Following are the arterial blood pressures, in millimeters of mercury (mm Hg), for a random sample of 16 children of diabetic mothers.

Apply the *t*-interval procedure to these data to find a 95% confidence interval for the mean arterial blood pressure of all children of diabetic mothers. Interpret your result in words. (*Note:* $\bar{x}$ = 85.99 mm Hg and s = 8.08 mm Hg)

C.I. 0.05 $\quad df = 15 \quad t = 2.131$

$85.99 \pm 2.131\left(\frac{8.08}{\sqrt{16}}\right) \quad 81.69 \leftrightarrow 90.29$

7) **(10 points) Worker Fatigue.** A study by M. Chen et al. titled "Heat Stress Evaluation and Worker Fatigue in a Steel Plant" (*American Industrial Hygiene Association*, Vol. 64, pp. 352–359) assessed fatigue in steel-plant workers due to heat stress. A random sample of 29 casting workers had a mean post-work heart rate of 78.3 beats per minute (bpm). At the 5% significance level, do the data provide sufficient evidence to conclude that the mean post-work heart rate for casting workers exceeds the normal resting heart rate of 72 bpm? Assume that the population standard deviation of post-work heart rates for casting workers is 11.2 bpm

$H_0 = \mu = 72$

$H_a = \mu > 72$

$$z = \frac{78.3 - 72}{11.2/\sqrt{29}} = 3.03$$

Reject Ho

μ is higher than 72 bpm