Use the following information to answer questions 1 - 3.

A person has diabetes when oral glucose tolerance tests show that the blood glucose level at 2 hours is equal to or more than 200 mg/dL. Suppose that $n = 7$ pre-diabetic patients visit a clinic to have their blood glucose level measured. The data are displayed below.

Unordered:	241	175	226	206	297	212	199
Ordered:	175	199	206	212	226	241	297

___A___ 1. What is the median of this dataset? (3 pts)

A) 212
B) 209
C) 219
D) 206

___C___ 2. Find Q1 and Q3. (3 pts)

A) $Q1 = 199, \quad Q3 = 233.5$
B) $Q1 = 202.5$, $Q3 = 241$
C) $Q1 = 202.5$, $Q3 = 233.5$
D) $Q1 = 233.5$, $Q3 = 241$

___B___ 3. Are there any outside values in the dataset? (3 pts)

A) Yes, 175 is the only outside value.
B) Yes, 297 is the only outside value.
C) Yes, both 175 and 297 are outside values.
D) No outside values.

Use the following information to answer questions 4 - 5.

Among females in the U.S. between 18 and 74 years of age, diastolic blood pressure (DBP) is normally distributed with mean $\mu = 77$ mm Hg and standard deviation $\sigma = 11.6$ mm Hg.

4. What is the probability that a randomly selected woman has:

   A) DBP less than 60 mm Hg? (4 pts)

$$\begin{aligned}
\Pr(X \leq 60) &= \Pr(Z \leq \frac{60-77}{11.6}) = \Pr(Z \leq -1.4655) \\
&= \Pr(Z \leq -1.47) \\
&= \boxed{0.0708} \quad \text{(Table B)}
\end{aligned}$$

   B) DBP over 90 mm Hg? (4 pts)

$$\begin{aligned}
\Pr(X > 90) &= \Pr(Z > \frac{90-77}{11.6}) = \Pr(Z > 1.1207) \\
&= \Pr(Z > 1.12) \\
&= \boxed{0.1314} \quad \text{(Table B)}
\end{aligned}$$

   C) DBP between 60 and 90 mm Hg? (4 pts)

$$\begin{aligned}
\Pr(60 \leq X \leq 90) &= \Pr(X \leq 90) - \Pr(X \leq 60) \\
&= [1 - \Pr(X > 90)] - \Pr(X \leq 60) \\
&= [1 - 0.1314] - 0.0708 \\
&= 0.8686 - 0.0708 \\
&= \boxed{0.7978}
\end{aligned}$$

   D) DBP more than 125 mm Hg? (4 pts)

$$\begin{aligned}
\Pr(X > 125) &= \Pr(Z > \frac{125-77}{11.6}) = \Pr(Z > 4.1379) \\
&= \Pr(Z > 4.14) \\
&\approx \boxed{0} \quad \text{(knowledge of } N(0,1)\text{)} \\
&\text{-OR-} \\
&< \boxed{0.0002} \quad \text{(bound from Table B)}
\end{aligned}$$

5. What value corresponds to the 90^{th} percentile of DBP? (4 pts)

$$X = \mu + z_{0.9}(\sigma) = 77 + 1.28(11.6) = \boxed{91.848} \text{ mm Hg}$$

   Therefore, 90% of women in the U.S. have a diastolic blood pressure less than or equal to 91.48, or 92 mm Hg.

Use the following information to answer questions 6 - 9.

Let X represent the number of diagnostic services a child receives during an office visit to a pediatric specialist (services might include blood tests and urinalysis). The probability mass function for X is given below

x	0	1	2	3	4	5
$\mathbf{Pr(X = x)}$	0.671	0.229	0.053	??	0.01	0.006

___B___ 6. What is the probability that a child receives three (3) diagnostic services in a visit? (3 pts)

A) 0.969
B) 0.031
C) 0.13
D) Not enough information to tell.

___C___ 7. What is the probability that a child receives **no more than** two (2) services in a visit? (3 pts)

A) 0.047
B) 0.9
C) 0.953
D) 0.1

___D___ 8. What is the probability that a child receives four (4) or five (5) services in a visit? (3 pts)

A) 0.984
B) 0.061
C) 0.01
D) 0.016

___A___ 9. What is the expected value of X? (3 pts)

A) 0.498
B) 0.405
C) 0.795
D) Not enough information to calculate.

Use the following information to answer questions 10 - 13.

The height of men in the general population has mean $\mu = 69$ inches, and standard deviation $\sigma = 2.8$ inches. An SRS of 25 male students at UNC has an average height of $\bar{x} = 70$ inches. We would like to conduct a 2-sided test of $H_0 : \mu = 69$ against $H_A : \mu \neq 69$ at the $\alpha = 0.05$ level of significance.

10. What is the value of $SE_{\bar{x}}$? (4 pts)

$$SE_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{2.8}{\sqrt{25}} = 0.56 \text{ inches}$$

___B___ 11. What is the appropriate test statistic? (4 pts)

A) $z = -1.67$

B) $z = 1.79$

C) $z = -0.56$

D) $z = 0.36$

___D___ 12. What can we say about the p-value and our test decision? (4 pts)

A) $p = 0.0367$; Reject H_0 since $p < \alpha$

B) $p = 0.0367$; Fail to reject H_0 since $p < \alpha$

C) $p = 0.0734$; Reject H_0 since $p > \alpha$

D) $p = 0.0734$; Fail to reject H_0 since $p > \alpha$

___B___ 13. Suppose we find out later that the average height of males at UNC is actually 72 inches. What kind of error have we made? (4 pts)

A) Type I error

B) Type II error

C) Type III error

D) No error

___A___ 14. As the confidence level increases, the length of a $(1-\alpha)100\%$ confidence interval ________. (4 pts)

A) Increases

B) Decreases

C) Stays the same

Use the following information to answer questions 15a-c and 16.

When eight (8) people in Massachusetts were hospitalized during an unexplained episode of vitamin D intoxication, it was suggested that these unusual occurrences might be the result of excessive supplementation of dairy milk. Blood levels of calcium (mmol/l) for each individual at the time of admission are shown below.

2.92 3.84 2.37 2.99 2.67 3.17 3.74 3.44

15. A) Calculate the mean of these data. (3 pts)

$$\bar{x} = \frac{1}{n}\sum x_i = \frac{25.14}{8} = 3.1425 \text{ mmol/l}$$

B) Suppose prior research suggests that in the general population, the standard deviation of calcium is $\sigma = 0.45$. Based on the hospital data, what is the margin of error for an 'exact' 95% confidence interval? (4 pts)

$$\begin{aligned} m &= z_{1-\alpha/2}\frac{\sigma}{\sqrt{n}} \\ &= z_{0.975}\frac{0.45}{\sqrt{8}} \\ &= (1.960)(0.1591) \\ &= 0.3118 \text{ mmol/l} \end{aligned}$$

C) What is the 'exact' 95% confidence interval for the hospital data? (3 pts)

$$\bar{x} \pm m = 3.1425 \pm 0.3118 = (2.8307,\ 3.4543) \text{ mmol/l}$$

B 16. Suppose that two additional subjects with this condition were admitted to the hospital, bringing our total sample size up to ten. What happens to the length of our 95% confidence interval? (4 pts)

A) Increases

B) Decreases

C) Stays the same

17. Classify the following variables as categorical, ordinal or quantitative. (3 pts each)

    A) Injury severity (1=fatal, 2=severe, 3=moderate, 4=minor) ORDINAL
    B) Concentration of arsenic in a sample of well water (mg/L) QUANTITATIVE
    C) Religious identity (1=Buddhist, 2=Christian, 3=Hindu, 4=Jewish, 5=Muslim) CATEGORICAL
    D) Number of previous miscarriages (1=None, 2=One, 3=Two or more) ORDINAL

___A___ 18. Suppose the AARP selects an SRS of size $n = 500$ from its members over age 80, and sends out a survey to each of these 500 members. The survey is designed to assess quality of life after age 80. Unfortunately, 100 of the survey recipients are too sick to complete the survey. The remaining 400 all report a quality of life ranging from moderate to good. What kind of bias does this introduce into the study? (3 pts)

    A) Nonresponse bias
    B) Volunteer bias
    C) Undercoverage bias
    D) Equipoise

___B___ 19. In a clinical trial on glaucoma patients, we would like to assess the effectiveness of a new drug in reducing pressure of fluid in the eye compared to a placebo treatment. The doctors randomly assign the patients to one of the two treatment groups. Neither the patients nor their doctors know which treatment is being taken by whom. This is an example of an experiment with _______________. (3 pts)

    A) Single blinding
    B) Double blinding
    C) Triple blinding
    D) Undercoverage

___B___ 20. A set of midterm exam scores has a median that is much larger than the mean. Which of the following statements is most consistent with this information? (3 pts)

    A) A stemplot of the data would be symmetric.
    B) A stemplot of the data would be negatively skewed.
    C) A stemplot of the data would be positively skewed.
    D) The data set must be so large that it would be better to draw a histogram rather than a stemplot.

Use the following information to answer questions 21 - 22.

In an investigation of the risk factors for cardiovascular disease, levels of serum cotinine, a metabolic product of nicotine, were recorded for a group of smokers and a group of nonsmokers. The data for each group are displayed in the frequency tables below.

Table 1: Frequency Table of Cotinine Levels for Smokers

Cotinine Level (ng/ml)	**Smokers**
0-13	78
14-49	133
50-99	142
100-149	206
150-199	197
200-249	220
250-299	151
300+	412
Total	1539

Table 2: Frequency Table of Cotinine Levels for Nonsmokers

Cotinine Level (ng/ml)	**Nonsmokers**
0-13	3300
14-49	72
50-99	23
100-149	15
150-199	7
200-249	8
250-299	9
300+	11
Total	3445

21. What percentage of Smokers had Cotinine Levels less than 50 ng/ml? (2 pts)

$$\Pr(\text{Cotinine } < 50) = \frac{78 + 133}{1539} = \boxed{0.1371}$$

Therefore, 13.71% of smokers had cotinine levels less than 50 ng/ml.

22. What percentage of Nonsmokers had Cotinine Levels less than 50 ng/ml? (2 pts)

$$\Pr(\text{Cotinine } < 50) = \frac{3300 + 72}{3445} = \boxed{0.9788}$$

Therefore, 97.88% of nonsmokers had cotinine levels less than 50 ng/ml.