Show all work on scratch paper and number each problem on scratch paper.

As part of a statistics project, a 6th grade teacher brings to class a container with 300 red marbles and 500 white marbles which are thoroughly mixed. To figure out how many marbles in the container are red without actually counting them all, a student randomly draws 40 marbles from the container. Of the 40 marbles drawn, 16 are red.

1) The target population consists of
   A) the 16 marbles drawn by the student.
   B) the 40 marbles drawn by the student.
   C) the 800 marbles in the container.
   D) the 300 red marbles in the container.
   E) none of these

2) The sample consists of
   A) the 40 marbles drawn by the student.
   B) the 16 red marbles drawn by the student.
   C) the 300 red marbles in the container.
   D) the 800 marbles in the container.
   E) none of these

3) The sampling proportion is
   A) 5\frac{1}{3}\%.
   B) 8\%.
   C) 13\frac{1}{3}\%
   D) 37\frac{1}{2}\%.
   E) none of these

\[
\frac{40}{800} = \frac{1}{20} = 0.05 = 5\%
\]

4) Suppose that the student is given the N-value. What is a reasonable estimate for the number of red marbles in the container?
   A) 300
   B) 220
   C) 480
   D) 107
   E) none of these

\[
\frac{16}{40} = \frac{x}{800} \Rightarrow 0.4 = \frac{x}{800} \Rightarrow x = (0.4)(800) = 320
\]

5) The value 16/40 is
   A) the response rate.
   B) a statistic.
   C) the sampling error.
   D) the sampling proportion.
   E) a parameter.
6) Any data collection process in which the data are collected from a selected subgroup of the population is called
   A) a census.
   B) a parameter.
   C) a statistic.
   D) a survey.
   E) none of these

7) In 2004, exit polls on the day of the election showed presidential candidate John Kerry ahead of George W. Bush. Later, it was found that those that voted for Bush were less interested in answering exit polls than other voters. This fact illustrates that the 2004 presidential exit polls were flawed because
   A) the sample size was too small.
   B) the sampling proportion was too small.
   C) of non-response bias.
   D) they were not a stratified survey.
   E) of sampling variability.

The following question(s) refer(s) to the capture-recapture method: \( n_1 \) denotes the size of the tagged (captured) sample, \( n_2 \) denotes the size of the second (recaptured) sample, and \( k \) denotes the number of tagged individuals in the second sample.

8) If \( n_1 = 500 \), \( n_2 = 300 \), and \( k = 25 \), an estimate for the size of the population is
   A) 1500.
   B) 2000.
   C) 4500.
   D) 15.
   E) none of these

\[
\frac{n_1}{N} = \frac{k}{n_2} \Rightarrow \frac{500}{N} = \frac{25}{300} \Rightarrow N = \left( \frac{300}{25} \right) \times 500 = 6000
\]

9) The data below gives the eye colors of 20 students in a Statistics class.
   green  blue  brown  blue  blue
   brown  blue  brown  blue  green
   blue  brown  brown  blue  brown
   blue  brown  blue  blue  blue

   a) Make a frequency table for this data.
   b) Make a relative frequency table for this data.
   c) Make a bar graph for this data.
The data in the figure below represents the number of stars earned by 140 performers in a talent competition.

10) How many performers earned 4 stars?
   A) 5
   B) 10
   C) 4
   D) none of these

   530 of 140
   = .375 x 140 = 7

11) How many performers earned more than the median number of stars?
   A) 30
   B) 49
   C) 91
   D) 82
   E) none of these

   20% + 50% + 50% = 30% earned 3, 4, or 5 stars

The scores on a 30-point multiple-choice exam are given in the following frequency table:

<table>
<thead>
<tr>
<th>Exam Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>6</td>
</tr>
<tr>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>26</td>
<td>1</td>
</tr>
<tr>
<td>27</td>
<td>6</td>
</tr>
<tr>
<td>28</td>
<td>6</td>
</tr>
<tr>
<td>29</td>
<td>4</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
</tr>
</tbody>
</table>

12) The third quartile on the exam is
   A) 27.5.
   B) 28.
   C) 27.
   D) 26.5.
   E) none of these

   Q3 = third quartile
   = 75th percentile

   75% of 30 = .75 x 30 = 22.5
   data value at position 22.5 is 28
The data in the figure below represents the annual salaries of 120 professional mathematicians.

![Salary Distribution Chart]

13) Sue, a professional mathematician, makes $80,000 per year. In what percentile does this place her?
   A) 80th percentile  
   B) 71st percentile  
   C) 34th percentile  
   D) 92nd percentile  
   E) none of these

14) An approximate value for the interquartile range of the salary data is
   A) $21,500.  
   B) $28,500.  
   C) $32,500.  
   D) $70,000.  
   E) $10,000.

Use the data set \(\{0, -1, -3, 3, -5, -7, 10\}\) to answer the following question(s).

15) The mean of the data set is
   A) -0.5.  
   B) 0.  
   C) 3.  
   D) 0.25.  
   E) none of these

16) The 15th percentile of the data set is
   A) -3.  
   B) -4.  
   C) -2.  
   D) -5.  
   E) none of these.

17) Find the five-number summary for the data set \(\{-7, -4, -1, 3, 3, 10\}\).  

18) Draw a boxplot for the data set. Put your boxplot below.
The box plots represent a comparison of the annual salaries of a group of opera and a group of country western singers respectively.

19) The range of salaries for the group of country western singers is approximately
   A) $15,000.
   B) $40,000.
   C) $80,000.
   D) $60,000.
   E) none of these

   \[ 90000 - 25000 = 65000 \]

20) The interquartile range of salaries for the group of country western singers is
   A) $40,000.
   B) $15,000.
   C) $50,000.
   D) $10,000.
   E) none of these

   \[ 50000 - 35000 = 15000 \]

Use the data set \{2, 3, 1, 8\} to answer the following question(s).

21) Find the standard deviation of the data set.

\[
\text{Average} = \frac{2+3+1+8}{4} = 3.5 = A
\]

\[
\begin{array}{c|c|c}
X & X-A & (x-A)^2 \\
\hline
2 & -1.5 & 2.25 \\
3 & -0.5 & 0.25 \\
1 & -2.5 & 6.25 \\
8 & 4.5 & 20.25 \\
\end{array}
\]

\[
\frac{29}{4} = 7.25
\]

\[
\sqrt{7.25} = 2.69
\]

Total = 29
22) A fair coin is tossed three times. Which of the following describes the sample space for this random experiment?

A) HHH, HHT, HTH, THH, HTT, THT, TTH, TTT
B) 3 H's, 2 H's and 1 T, 1 H and 2 T's, 3 T's
C) H, T
D) (HHH, TTT)
E) none of these

23) A person shoots ten consecutive free throws and on each toss we observe either a success or a failure. How many different outcomes are there in the sample space?

\[2^{10} = 1024\]

A French restaurant offers a menu consisting of 5 different appetizers, 3 different salads, 2 different soups, 7 different main courses, and 3 different desserts. The restaurant offers different combinations of "fixed price dinners" on different days of the week.

24) On Monday through Thursday, the "fixed price dinner" consists of a choice of appetizer, a soup, a main course, and a dessert. Assuming you don't pass on any of these, how many different "fixed price dinners" are possible on these days?

\[5 \cdot 2 \cdot 7 \cdot 3 = 210\]

25) A music CD consists of 10 songs numbered 1 through 10. In how many ways can the 10 songs be ordered by the random function on a CD player?

\[10! = 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 3628800\]

26) A Tasmanian lottery ticket consists of choosing 7 different numbers between (and including) 10 and 52. The number of possible lottery tickets is given by

\[\text{A license plate consists of any five capital letters from the ordinary English alphabet (A through Z) except for the letters O, I, and Q.} \]

27) How many of the license plates have no repeated letters?

26 letters - 3 letters = 23 letters

\[23 \cdot 22 \cdot 21 \cdot 20 \cdot 19 = \]

There are 43 numbers to choose from:

\[\begin{align*}
10, 11, \ldots, 19, 20, 21, \ldots, 29 & , 30, 31, \ldots, 39, 40, 41, \ldots, 49, 50, 51, 52 \\
10 numbers & \\
\binom{43}{7} = \frac{43!}{(43-7)! \cdot 7!} & = \frac{43 \cdot 42 \cdot 41 \cdot 40 \cdot 39 \cdot 38 \cdot 37}{7! \cdot 4 \cdot 3 \cdot 2 \cdot 1} \\
& = 2,224,114
\end{align*}\]