Use the following to answer Problems 1 and 2: A simple random sample of 50 students will be taken from a local community college, which has a total of about 1500 students. Another simple random sample of 50 students will be taken from a large state university, which has a total of approximately 20,000 students. The sampled students will each answer a one-question survey which reads: “About how many CDs do you own?” The sample average number of CDs owned will be calculated for the two sets of students.

Problem 1. What sampling technique is being used to select the two sets of students? (1 pts)  
A) Simple random sampling.
B) Stratified random sampling.
C) Multistage sampling.
D) Convenience sampling.

Problem 2. What can we conclude about the sampling variability in the sample average number of CDs of the students sampled from the small community college as compared to that in the sample average of the students sampled from the large state university? (1 pts)  
A) The sample mean from the small community college has less sampling variability than that from the large state university, because there are fewer students at the small community college.
B) The sample mean from the small community college has more sampling variability than that from the large state university, because there are more students at the large state university.
C) The sample mean from the small community college has about the same sampling variability as that from the large state university, because the sample sizes are equal.
D) It is impossible to make any statements about the sampling variability of the two sample means, because the students surveyed came from different schools.
Problem 3. Consider the die-toss experiment. Define the following events:

\[ A: \{\text{Toss an even number}\} = \{2,4,6\} \]
\[ B: \{\text{Toss a number less than or equal to 3}\} = \{1,2,3\} \]
\[ S = \{1,2,3,4,5,6\} \]

(a) Calculate \( P(A) \) and \( P(B) \) assuming the die is fair. (1 pts)

\[
P(A) = \frac{3}{6} = \frac{1}{2} = 0.5, \quad P(B) = \frac{3}{6} = \frac{1}{2} = 0.5
\]

(b) Calculate \( P(A \text{ or } B) \) assuming the die is fair. (1 pts)

\[
A \text{ or } B = \{1,2,3,4,6\} \implies P(A \text{ or } B) = \frac{5}{6} = 0.833
\]

(c) Calculate \( P(A \text{ and } B) \) assuming the die is fair. (1 pts)

\[
A \text{ and } B = \{2\} \implies P(A \text{ and } B) = \frac{1}{6} = 0.167
\]

(d) Please check whether two events \( A \) and \( B \) are independent or dependent. (1 pts)

\[
P(A \text{ and } B) = \frac{1}{6} = 0.167 \neq 0.25 = \frac{1}{2} \times \frac{1}{2} = P(A) \times P(B).
\]

\( \Rightarrow \) \( A \) and \( B \) are not independent (= dependent).
Problem 4. If you draw an M&M candy at random from a bag of the candies, the candy you draw will have one of six colors. The probability of drawing each color depends on the proportion of each color among all candies made. Assume the table below gives the probabilities for the color of a randomly chosen M&M:

<table>
<thead>
<tr>
<th>Color</th>
<th>Brown</th>
<th>Red</th>
<th>Yellow</th>
<th>Green</th>
<th>Orange</th>
<th>Blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>0.3</td>
<td>0.3</td>
<td>?</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

(a) What is the probability of drawing a yellow candy? (1 pts)

\[
P(\text{Yellow}) = 1 - P(\text{not Yellow})
= 1 - \{ P(\text{Brown}) + P(\text{Red}) + P(\text{Green}) + P(\text{Orange}) + P(\text{Blue}) \}
= 1 - \{0.3 + 0.3 + 0.1 + 0.1 + 0.1\} = 1 - 0.9 = 0.1.
\]

(b) What is the probability of not drawing a red candy? (1 pts)

\[
P(\text{not Red}) = 1 - P(\text{Red}) = 1 - \{0.3\} = 0.7.
\]

(c) What is the probability that you draw neither a brown nor a green candy? (1 pts)

\[
P(\text{neither Brown nor Green}) = 1 - P(\text{Brown or Green})
= 1 - [P(\text{Brown}) + P(\text{Green})]
= 1 - \{0.3 + 0.1\} = 0.6.
\]

(d) If you select two M&M’s and the colors are independent, then what is the probability that both are the same color? (1 pts)

\[
P(\text{Both are the same color}) = P(\text{Brown}) \times P(\text{Brown})
+ P(\text{Red}) \times P(\text{Red}) + P(\text{Yellow}) \times P(\text{Yellow})
+ P(\text{Green}) \times P(\text{Green}) + P(\text{Orange}) \times P(\text{Orange})
+ P(\text{Blue}) \times P(\text{Blue}) = 0.3 \times 0.3 + 0.3 \times 0.3 + 0.1 \times 0.1
+ 0.1 \times 0.1 + 0.1 \times 0.1 + 0.1 \times 0.1 = 0.22
\]