Quiz 3 (Blue)

Please show your work in all the problems.

**Problem 1**: True or False, and explain.

1. When you draw at random with replacement the draws are dependent.
   - **FALSE**: When you draw at random with replacement you do not modify the chance of the next draw.
2. If two events are independent the conditional probability is equal to the unconditional probability.
   - **TRUE**: If two events are independent, the probability that one happens in not affected by the occurrence other event. This means $P(A|B) = P(A)$.
3. The binomial formula is an application of the multiplication rule only.
   - **FALSE**: The binomial formula uses the addition and the multiplication rule.
4. In the binomial formula the value of $p$ must be fixed in advance.
   - **TRUE**: We should know the probability of success $p$ in advance.
5. You do not need to check whether two events are mutually exclusive before applying the addition rule.
   - **FALSE**: You should check whether the two events are mutually exclusive before adding the probabilities. Otherwise the final probability value might be too big since you need to subtract the value of $P(A \text{ and } B)$ to the final probability.
6. If two events are mutually exclusive they are independent.
   - **FALSE**: These two concepts have different meanings. If the two events are mutually exclusive, when one happens the other one will not happen, therefore we get information about the other event and they will not be independent.

**Problem 2**: Two tickets are drawn at random without replacement from the box: 1 1 3 3 4 5

1. What is the probability that the second ticket is three?
   - $2/5$. This is an independent question of what might happen in the second draw without looking at the first draw.

2. What is the probability that the second ticket is three, given that the first is one?
   - $2/4$
Problem 3: A box contains 7 red marbles and 3 green ones. Six draws are made at random without replacement. True or False: the chance that the 3 green marbles are drawn equals:

\[
\frac{6!}{3!3!} \left( \frac{7}{10} \right)^3 \left( \frac{3}{10} \right)^3
\]

Explain briefly. (4 pts)

The binomial formula is not applicable if we have draws without replacement because this introduces dependence. We can not apply the multiplication rule to find the probability for any combination of draws, just by multiplying the probabilities as in the formula: \( \left( \frac{7}{10} \right)^3 \left( \frac{3}{10} \right)^3 \).

Problem 4: If A is an event and \( A^c \) is the opposite event, calculate:

\[ P(A|A^c) \]

(Bonus point: 1 pt)

If \( A^c \) happens, A can not happen, therefore the conditional probability \( P(A|A^c) \) is zero.