A2.S.12: Use permutations, combinations, and the Fundamental Principle of Counting to determine the number of elements in a sample space and a specific subset (event)

1. 060034a, P.I. A2.S.12
    Paul orders a pizza. Chef Carl randomly chooses two different toppings to put on the pizza from the following: pepperoni, onion, sausage, mushrooms, and anchovies. If Paul will not eat pizza with mushrooms, determine the probability that Paul will *not* eat the pizza Chef Carl has made.

2. 010126a, P.I. A2.S.12
    Sal has a small bag of candy containing three green candies and two red candies. While waiting for the bus, he ate two candies out of the bag, one after another, without looking. What is the probability that both candies were the same color?

3. 069932a, P.I. A2.S.12
    A bookshelf contains six mysteries and three biographies. Two books are selected at random without replacement.
    a What is the probability that both books are mysteries?
    b What is the probability that one book is a mystery and the other is a biography?

4. 060234a, P.I. A2.S.12
    Alexi's wallet contains four $1 bills, three $5 bills, and one $10 bill. If Alexi randomly removes two bills without replacement, determine whether the probability that the bills will total $15 is greater than the probability that the bills will total $2.

5. 010034a, P.I. A2.S.12
    Three roses will be selected for a flower vase. The florist has 1 red rose, 1 white rose, 1 yellow rose, 1 orange rose and 1 pink rose from which to choose.
    a How many different three rose selections can be formed from the 5 roses?
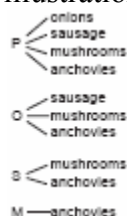   *b* What is the probability that 3 roses selected at random will contain 1 red rose, 1 white rose, and 1 pink rose?
    c What is the probability that 3 roses selected at random will *not* contain an orange rose?

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[4] $\frac{4}{10}$ and appropriate work is shown, such as the following illustration or any other correct method:

[3] Appropriate work is shown, but one computational error is made.

or [3] Appropriate work and complement $\frac{6}{10}$ are shown.

or [3] Appropriate work is shown, but the answer is incomplete.

[2] $_5C_2$ and the work is appropriate but incomplete.

or [2] 10 but appropriate work is shown.

or [2] A correct sample space or tree diagram is shown.

[1] Incorrect work leading to $0 \le$ fraction ≤ 1 or $0 \le$ percent ≤ 100 is shown.

or [1] $\frac{4}{10}$ but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[1]

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[3] $\frac{8}{20}$ or an equivalent answer, and appropriate work is shown, such as using a tree diagram or writing the equation $\frac{6}{20} + \frac{2}{20} = \frac{8}{20}$.

[2] One computational error is made in finding $\frac{6}{20}$ or $\frac{2}{20}$, but an appropriate sum is found.

or [2] $\frac{2}{20}$ and $\frac{6}{20}$ are found, but no sum is shown.

[1] $\frac{6}{20}$ or $\frac{2}{20}$, and appropriate work is shown.

or [1] An appropriate answer is found, using replacement with a tree diagram or an equation such as $\frac{3}{5} \bullet \frac{3}{5} + \frac{2}{5} \bullet \frac{2}{5} = \frac{13}{25}$.

or [1] $\frac{8}{20}$, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[2]

a [2] $\dfrac{30}{72}$ or an equivalent value is found and an appropriate explanation is given.

[1] An acceptable method is used correctly, such as a tree diagram, sample space, or combinations, but the correct answer is not given.

or [1] Replacement is used, and an answer of $\dfrac{36}{81}$ or an equivalent is found.

or [1] $\dfrac{30}{72}$ and no work is shown.

b [2] $\dfrac{36}{72}$ or an equivalent value is found and an appropriate explanation is given.

or [2] An appropriate probability for an incorrect denominator for part *a* is found.

[1] An appropriate method is shown, but one computational mistake is made.

or [1] Replacement is shown, and the answer $\dfrac{36}{81}$ or an equivalent is found.

or [1] The student does not take into account both orders and answers $\dfrac{18}{72}$ or an equivalent.

or [1] $\dfrac{36}{72}$ and no work is shown.

or *a* and *b*

[1] An error in method is made but the erroneous answer is interpreted correctly in either part *a* or *b* or both.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[3]   incorrect procedure.

[4] No, and an appropriate explanation is given, such as $P(15) = \dfrac{6}{56} < P(2) = \dfrac{12}{56}$.

[3] One of the two probabilities is found correctly, but one computational error is made in finding the other, but an appropriate conclusion is drawn, based on the values found.

or [3] Replacement is used to conclude $P(15) = \dfrac{6}{64} < P(2) = \dfrac{12}{64}$.

or [3] The two probabilities are found correctly, but no conclusion or the incorrect conclusion is drawn.

[2] One of the probabilities is found correctly, but one computational error is made in finding the other, and no conclusion or the incorrect conclusion is drawn.

[1] An appropriate method is used, such as a tree diagram or sample space, but the probabilities are not determined or are determined incorrectly.

or [1] $P(15) = \dfrac{6}{56} < P(2) = \dfrac{12}{56}$, but no work is shown.

[0] No, but no work is shown.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[4]   incorrect procedure.

a [2] 10 and an appropriate tree diagram, list,
sample space, or $_5C_3 = 10$ is shown.
[1] 10 and no work is shown.
or [1] An appropriate method is shown, but
not all 10 possible combinations are listed

b [1] $\dfrac{1}{10}$

or [1] An appropriate answer is found for an
incorrect response in part a.

c [1] $\dfrac{4}{10}$ *or* $\dfrac{2}{5}$ *or* 0.4

or [1] An appropriate answer is found for an
incorrect response in part a.
a and b and c [0] A zero response is
completely incorrect, irrelevant, or incoherent
or is a correct response that was obtained by
[5]   an obviously incorrect procedure.