S.CP.B.9: Permutations 2

1 Determine how many three-letter arrangements are possible with the letters *A*, *N*, *G*, *L*, and *E* if no letter may be repeated.

2 Find the total number of different twelve-letter arrangements that can be formed using the letters in the word *PENNSYLVANIA.*

3 Find the number of possible different 10-letter arrangements using the letters of the word "STATISTICS."

4 Determine how many eleven-letter arrangements can be formed from the word "CATTARAUGUS."

5 The letters of any word can be rearranged. Carol believes that the number of different 9-letter arrangements of the word "TENNESSEE" is greater than the number of different 7-letter arrangements of the word "VERMONT." Is she correct? Justify your answer.

6 Jamal has forgotten his password for the school computers. He knows that it must be 4 characters long (only lowercase letters or digits). He also knows that his password begins with one of 26 letters and ends with a digit. Determine how many different 4-character passwords are possible for Jamal if no letter or digit may be repeated.

7 A password consists of three digits, 0 through 9, followed by three letters from an alphabet having 26 letters. If repetition of digits is allowed, but repetition of letters is not allowed, determine the number of different passwords that can be made. If repetition is not allowed for digits or letters, determine how many fewer different passwords can be made.

8 A large company must chose between two types of passwords to log on to a computer. The first type is a four-letter password using any of the 26 letters of the alphabet, without repetition of letters. The second type is a six-digit password using the digits 0 through 9, with repetition of digits allowed. Determine the number of possible four-letter passwords. Determine the number of possible six-digit passwords. The company has 500,000 employees and needs a different password for each employee. State which type of password the company should choose. Explain your answer.

9 All seven-digit telephone numbers in a town begin with 245. How many telephone numbers may be assigned in the town if the last four digits do *not* begin or end in a zero?

10 The telephone company has run out of seven-digit telephone numbers for an area code. To fix this problem, the telephone company will introduce a new area code. Find the number of new seven-digit telephone numbers that will be generated for the new area code if both of the following conditions must be met:
• The first digit cannot be a zero or a one.
• The first three digits cannot be the emergency number (911) or the number used for information (411).

11 There were seven students running in a race. How many different arrangements of first, second, and third place are possible?

12 Six members of a school's varsity tennis team will march in a parade. How many different ways can the players be lined up if Angela, the team captain, is always at the front of the line?

13 A certain state is considering changing the arrangement of letters and numbers on its license plates. The two options the state is considering are:
Option 1: three letters followed by a four-digit number with repetition of both letters and digits allowed
Option 2: four letters followed by a three-digit number without repetition of either letters or digits
[Zero may be chosen as the first digit of the number in either option.]
Which option will enable the state to issue more license plates? How many *more* different license plates will that option yield?

14 In Jackson County, Wyoming, license plates are made with two letters (*A* through *Z*) followed by three digits (0 through 9). The plates are made according to the following restrictions:
• the first letter must be *J* or *W*, and the second letter can be any of the 26 letters in the alphabet
• no digit can be repeated
How many different license plates can be made with these restrictions?

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Answer Section

1 ANS:
60. ${}_5P_3 = 60$

REF: 060931ia

2 ANS:
39,916,800. $\frac{{}_{12}P_{12}}{3!\cdot 2!} = \frac{479,001,600}{12} = 39,916,800$

REF: 081035a2

3 ANS:
$\frac{{}_{10}P_{10}}{3!\cdot 3!\cdot 2!} = \frac{3,628,800}{72} = 50,400$

REF: 061330a2

4 ANS:
$\frac{11!}{3!\cdot 2!\cdot 2!} = 1,663,200$

REF: 011631a2

5 ANS:
No. TENNESSEE: $\frac{{}_9P_9}{4!\cdot 2!\cdot 2!} = \frac{362,880}{96} = 3,780$. VERMONT: ${}_7P_7 = 5,040$

REF: 061038a2

6 ANS:
$26 \times 34 \times 33 \times 10 = 291,720$

REF: 081628a2

7 ANS:
15,600,000, 4,368,000. $10 \times 10 \times 10 \times 26 \times 25 \times 24 = 15,600,000$. $10 \times 9 \times 8 \times 26 \times 25 \times 24 = 11,232,000$.
$15,600,000 - 11,232,000 = 4,368,000$.

REF: 011037ia

8 ANS:
$26 \times 25 \times 24 \times 23 = 358,800$. $10^6 = 1,000,000$. Use the numeric password since there are over 500,000 employees

REF: 061239ia

9 ANS:
8,100. $9 \times 10 \times 10 \times 9 = 8,100$

REF: 060023a

10 ANS:
7,980,000. $8\times10\times10\times10\times10\times10\times10\times10-2(1\times1\times1\times10\times10\times10\times10\times10)=7980000$

REF: 080034a

11 ANS:
210. ${}_7P_3=7\times6\times5=210$

REF: 060125a

12 ANS:
120. $1\times5\times4\times3\times2\times1=120$

REF: 010323a

13 ANS:
Option 2 will yield 82,576,000 more possibilities.
Option 1: $26\times26\times26\times10\times10\times10\times10=175,760,000$
Option 2: $26\times25\times24\times23\times10\times9\times8=258,336,000$

REF: 060329a

14 ANS:
37,440. $2\times26\times10\times9\times8=37,440$

REF: 010435a