- For questions 1 and 2: Define the set S to be $S = \{1, 2, \ldots, 7\}$ and the set T to be $T = \{1, 2, \ldots, 12\}$.

1. How many different functions are there whose domain is S and whose target set is T?

   A. $(2^{12})^{(2^7)}$ C. $P(2^{12}, 2^7)$ E. 7^{12}

   B. 12^7 D. $P(12, 7)$

2. How many different **one-to-one** functions are there whose domain is S and whose target set is T?

   A. $(2^{12})^{(2^7)}$ C. $P(2^{12}, 2^7)$ E. 7^{12}

   B. 12^7 D. $P(12, 7)$

- For questions 3-7: In a particular state, the lisence plates have 7 characters. Each character can be a captial letter or a digit except for 0. (The set of possibile digits is $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$.) A person witnesses a crime and remembers some information about the lisence plate of the get-away car. The authorities would like to figure out how many lisence plates need to be checked in each case. For each constraint given below, indicate the number of lisence plates that satisfy that constraint.

3. The lisence plate starts with a digit.

   A. $9 \cdot 6^{35}$ C. $9 \cdot P(34, 6)$ E. $P(35, 7)$

   B. $9 \cdot P(35, 6)$ D. $9 \cdot (35)^6$

4. Exactly 3 of the seven characters are digits.

   A. $\binom{7}{3} \cdot (35)^4$ C. $\binom{7}{3} \cdot (26)^4$ E. $P(7, 3) \cdot (26)^4$

   B. $P(7, 3) \cdot (35)^4$ D. $\binom{7}{3} \cdot 9^3 \cdot (26)^4$

5. No character appears twice anywhere on the lisence plate.

   A. $(35)^7$ C. 7^{35} E. $\binom{35}{7}$

   B. $P(35, 7)$ D. $9^7 \cdot (26)^7$

6. The first character is a digit and no characters appears twice anywhere on the lisence plate.

   A. $9 \cdot P(35, 6)$ C. 9^7 E. $9 \cdot (34)^6$

   B. $9 \cdot P(34, 6)$ D. $9 \cdot (35)^6$

7. No two consecutive characters are the same. That is to say, no where in the lisence plate are there two characters that are next to each other and are the same.

   A. $35 \cdot (34)^6$ C. $9 \cdot P(35, 6)$ E. $(35)^7$

   B. $9 \cdot P(34, 6)$ D. $(35)^6$

- For questions 8-10: There is a set of 10 jobs in a printer queue. There are two particular jobs in the queue called Job A and Job B.

8. How many different ways are there for the jobs to be ordered in the queue?

   A. 10
   B. 2^{10}
   C. $9!$
   D. $10!$
   E. $\binom{10}{2}$

9. How many ways are there for the jobs to be ordered in the queue if Job A will complete some time before Job B?

   A. $2 \cdot 9!$
   B. $\binom{10}{2}$
   C. $10!/2$
   D. $2 \cdot 10!$
   E. $P(10, 2)$

10. How many ways are there to order the jobs if Job A and B are next to each other in the queue?

    A. $2 \cdot 9!$
    B. $\binom{10}{2}$
    C. $10!/2$
    D. $2 \cdot 10!$
    E. $P(10, 2)$

- For questions 11-13: A group of five friends go to a restaurant for dinner. The restaurant offers 20 different main dishes.

11. Suppose that the group collectively orders five different dishes to share. The waiter just needs to place all five dishes in the center of the table. How many different possible orders are there for the group?

    A. $\binom{20}{5}$
    B. $P(20, 5)$
    C. 20^5
    D. 5^{20}
    E. $20 \cdot 5!$

12. Suppose that each individual orders a main course. The waiter must remember who ordered which dish as part of the order. It's possible for more than one person to order the same dish. How many different possible orders are there for the group?

    A. $\binom{20}{5}$
    B. $P(20, 5)$
    C. 20^5
    D. 5^{20}
    E. $20 \cdot 5!$

13. Suppose that each individual orders a main course. The waiter must remember who ordered which dish as part of the order. However, it happens that no two people order the same dish. How many different possible orders are there for the group?

    A. $\binom{20}{5}$
    B. $P(20, 5)$
    C. 20^5
    D. 5^{20}
    E. $20 \cdot 5!$

- For questions 14-15: A country has two political parties, the Demonstrators and the Repudiators. Suppose that the national senate consists of 100 members, 44 of which are Demonstrators and 56 of which are Repudiators.

14. How many ways are there to select a committee of 10 senate member with the same number of Demonstrators and Repudiators?

    A. $P(44,5)+P(56,5)$

    B. $P(44,5)\cdot P(56,5)$

    C. $\binom{44}{5}\binom{56}{5}$

    D. $\binom{44}{5}+\binom{56}{5}$

15. Now suppose that each party must select a speaker and a vice speaker. How many ways are there for the two speakers and two vice speakers to be selected?

    A. $\binom{44}{2}+\binom{56}{2}$

    B. $P(44,2)\cdot P(56,2)$

    C. $P(100,4)$

    D. $P(44,2)+P(56,2)$

    E. $\binom{44}{2}\binom{56}{2}$

- For questions 16-17: A distributed network has 40 servers.

16. 10 idential copies of a movie will be stored in the network such that each server has at most one copy of the movie. How many ways are there to select where the copies of the movie will be stored?

    A. $P(40,10)$

    B. 10^{40}

    C. $\binom{40}{10}$

    D. 40^{10}

    E. $\frac{40!}{(4!)^{10}}$

17. 10 different movies will be stored in the network such that each server has at most one movie. How many ways are there to select where the copies of the movie will be stored?

    A. $P(40,10)$

    B. 10^{40}

    C. $\binom{40}{10}$

    D. 40^{10}

    E. $\frac{40!}{(4!)^{10}}$

- For questions 18-19: A distributed network has 10 servers. 40 different movies will be stored in the network.

18. How many ways are there to select where the movies will be stored if there is no restriction on the number of movies stored at each server?

    A. 40^{10}

    B. $\frac{40!}{(4!)^{10}}$

    C. $P(40,10)$

    D. 10^{40}

    E. $\binom{40}{10}$

19. How many ways are there to select where the movies will be stored if the same number of movies are stored at each server?

    A. 40^{10}

    B. $\frac{40!}{(4!)^{10}}$

    C. $P(40,10)$

    D. 10^{40}

    E. $\binom{40}{10}$

- For question 20: A girl scout troop with 10 girl scouts and 2 leaders goes on a hike. When the path narrows, they must walk in single file with a leader at the front and a leader at the back.

20. How many ways are there for the entire troop (including the scouts and the leaders) to line up?

A. $2 \cdot 11!$
B. $12!$
C. $2 \cdot 10!$
D. $11!$
E. $12!/2$

- For question 21: A manager must select three members of her group to write three different software modules. There are 7 junior and 3 senior members of her group. The first module must be written by a senior person and the second module must be written by a junior person.

21. How many ways are there for her to assign the three members to the modules if no person can be assigned to more than one module?

A. $3 \cdot 7 \cdot 8$
B. $3 + 7 + 8$
C. $P(10, 3)$
D. $3 + 7 + 10$
E. $3 \cdot 7 \cdot 10$

- For questions 22-23: Two dozen donuts are given out to 24 kids so that each kid gets exactly one donut.

22. How many ways are there to distribute the donuts if the donuts are all different?

A. 24^{24}
B. $\binom{24}{24}$
C. $24!$
D. 2^{24}

23. How many ways are there to distribute the donuts if there are four varieties of donuts and exactly six of each variety?

A. 4^{24}
B. 6^{24}
C. $\frac{24!}{6!6!6!6!}$
D. $\frac{24!}{4!4!4!4!4!4!}$

- For questions 24-25: Ten donuts are given out to ten kids so that each kid gets exactly one donut. The donuts are all different. One of the kids is named Ignacio and another one of the kids is named Josephine. Among the ten donuts, there is one that is lemon-filled.

24. How many ways are there to distribute the donuts such that Ignacio gets the lemon-filled donut?

A. $10!$
B. $9!$
C. $2 \cdot 9!$
D. $\binom{10}{2} \cdot 8!$
E. $2 \cdot 8!$

25. How many ways are there to distribute the donuts such that either Ignacio or Josephine get the lemon-filled donut?

A. $10!$
B. $9!$
C. $2 \cdot 9!$
D. $\binom{10}{2} \cdot 8!$
E. $2 \cdot 8!$