GRE

考 满 分 G R E

ViS G12

数 学 冲 分 班

排 列 组 合 与 概 率

课 下 专 项 练 习

（建议用时：60min）

2.5 乘法原理、阶乘、排列与组合 Multiplication Principle, Factorial, Permutation and Combination

[知识点总览]

Suppose there are two choices to be made sequentially and that the second choice is independent of the first choice. Suppose also that there are k different possibilities for the first choice and m different possibilities for the second choice. The **multiplication principle** states that under those conditions, there are km different possibilities for the pair of choices.

More generally, suppose n objects are to be ordered from 1st to nth, and we want to count the number of ways the objects can be ordered. There are n choices for the first object, n − 1 choices for the second object, n − 2 choices for the third object, and so on, until there is only 1 choice for the nth object. Thus, applying the multiplication principle, the number of ways to order the n objects is equal to the product **n(n − 1)(n − 2)· · ·(3)(2)(1)**

Each order is called a **permutation**, and the product above is called the number of permutations of n objects.

Because products of the form n(n − 1)(n − 2)· · ·(3)(2)(1) occur frequently when counting objects, a special symbol n!, called **n factorial**, is used to denote this product. For example,

- 1!=1

- 2!=(2)(1)=2

- 3! = (3)(2)(1) = 6

- 4! = (4)(3)(2)(1) = 24

- n!=n (n-1) (n-2) (n-3) ⋯ ×2×1 （n≥3）

More generally, suppose that k objects will be selected from a set of n objects, where k ≤ n, and the k objects will be placed in order from 1st to kth. Then there are n choices for the first object, n − 1 choices for the second object, n − 2 choices for the third object, and so on, until there are n −k + 1 choices for the kth object. Thus, applying the multiplication principle, the number of ways to select and order k objects from a set of n objects is n(n−1)(n−2)· · ·(n−k+1). It is useful to note that

$$n(n-1)(n-2)\cdots(n-k+1) = n(n-1)(n-2)\cdots(n-k+1)\frac{(n-k)!}{(n-k)!}$$

$$= \frac{n!}{(n-k)!}$$

This expression represents the number of **permutations of n objects** taken k at a time, that is, the number of ways to select and order k objects out of n objects.

More generally, suppose that k objects will be chosen from a set of n objects, where $k \leq n$, but that the k objects will not be put in order. The number of ways in which this can be done is called the number of **combinations of n objects taken k at a time** and is given by the formula n! / k!(n - k)!

Another way to refer to the number of combinations of n objects taken k at a time is **n choose k**, and two notations commonly used to denote this number are $_nC_k$ and $C_n^{\ k}$.

[相关术语]

- multiplication principle 乘法原理

- factorial 阶乘

- permutation / arrangement 排列

- combination 组合

[核心考点]

1）乘法原理

- 做一件事，完成它需要分成 n 个步骤，做第一步有 m_1 种不同的方法，做第二步有 m_2 种不同的方法，……，做第 n 步有 m_n 种不同的方法。那么完成这件事共有 $N=m_1 \times m_2 \times m_3 \times \cdots \times m_n$ 种不同的方法

2）阶乘

- 利用乘法原理计算总方法数时，逐步完成一件事情的方法数逐渐递减 1，直至 1 的情况，此时，总可能方法数= n (n-1) (n-2) (n-3)… ×2×1，我们可以将其抽象概括为 n!

- n!=n (n-1) (n-2) (n-3)… ×2×1（n≥3）

- 0!=1

2）排列问题

- **定义：**一般地，从 n 个不同元素中取出 m（m≤n）个元素，按照一定的顺序排成一列，叫做从 n 个元素中取出 m 个元素的一个排列，简记为 A(n, m)

- **计算：**

$$A_n^m = n(n-1) \cdots (n-m+1) = \frac{n!}{(n-m)!}$$

- **简便计算：**A(n, m)等于从 n 开始往下，连续乘 m 项

3）常见排列问题

- 从 n 个数字里选 m 个数字，排一个 m 位数（m≤n）

- 从 n 个数字里选 m 个数字，排一个 m 位的密码（m≤n）

- 从 n 个人里选 m 个人，排座位/队伍（m≤n）

4）排列问题的判定标准

- 元素的使用不能重复，选择方法逐渐递减 1

- 与顺序有关

5）组合问题

- **定义：** 一般地，从 n 个不同的元素中，任取 m（m≤n）个元素为一组，叫作从 n 个不同元素中取出 m 个元素的一个组合（与顺序无关）

- **计算：**

$$C_n^m = \frac{A_n^m}{m!} = \frac{n!}{m!(n-m)!} = C_n^{n-m}$$

- **简便计算：** C(n, m)=（从 n 开始往下，连续乘 m 项）÷（m 的阶乘）

6）组合问题的判定标准

- 元素的使用不能重复，选择方法逐渐递减 1

- 与顺序无关

7）排列&组合问题常用思路

- 拆分法（标志词 or, no more than, at least）

- 拆步法

- 选空法

- 插空法

- 捆绑法

- 倒算法

- 追根溯源法

8）握手问题

- 净握手数=（握手人数×每人需握手次数）/2

[专项练习]

（建议用时：70min）

测试用时	正确率	错题编号
/min	/53	

阶乘

1. X/2=n!

If n is a positive integer, then X could be?

Indicate **all** such numbers.

A. 160

B. 360

C. 580

D. 720

E. 1440

（来源：考满分数学机经题 2018-11-23-Easy）

2. Quantity A: 4!

Quantity B: 5!-4!

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

（来源： GRE 数学最新最快最全机经 400 题（二）24：Easy）

3. （51!-50!）÷（50!-49!）=?

（来源：考满分数学机经题 2018-12-02-Easy）

4. (60!-59!)÷58!=

5. Quantity A: 60!×20!

Quantity B: 40!×30!

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

6. Quantity A: 89!-88!-87!

Quantity B: 88^2×87!

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

7. n and k are integers, n>k>1

Quantity A: (n-k)!

Quantity B: n!-k!

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

乘法原理

8. A positive integer is a palindrome if it reads exactly the same from right to left as it does from left to right. For example, 5 and 66 and 373 are all palindromes. How many palindromes are there between 1 and 1,000, inclusive?

9. N equals the number of positive 3-digit numbers that contain odd digits only (the same number could be used for more than once).

Quantity A: N

Quantity B: 125

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

（来源：考满分 GRE 数学机经 170 题-120-Medium）

10. Quantity A: The number of 3-digit integers all of whose digits are even (the same number could be used for more than once)

Quantity B: The number of 3-digit integers all of whose digits are odd (the same number could be used for more than once)

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

（来源：考满分 GRE 数学机经 170 题-73-Medium）

11. Set A={1, 2, 3}   Set B={1, 2, 3, 4}

Quantity A: The number of different four-digit integers that can be formed by elements from Set A (all the elements can be used by more than once)

Quantity B: The number of different three-digit integers that can be formed by elements from Set B (all the elements can be used by more than once)

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

12. A three-digit code for certain locks uses the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 according to the following constraints. The first digit cannot be 0 or 1, the second digit must be 0 or 1, and the second and third digits cannot both be 0 in the same code. How many different codes are possible?

A. 144

B. 152

C. 160

D. 168

E. 176

13. Set S = {1, 4, 7, 10}   **Set T** = {2, 3, 5, 8, 13}

x is a number in set S, and y is a number in set T.

Quantity A: The number of different possible values of the product xy

Quantity B: 20

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

14. Mark is supposed to fill three sectors of a garden with a selection of five colors of flowers. The same color could be used, but only twice at most, and not adjacent. In how many ways can the garden be decorated?
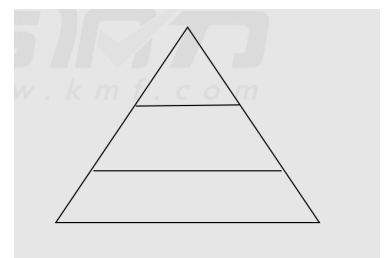
排列问题

15. Set T= {2, 3, 5, 6, 7, 8, 9}

Quantity A: The total number of positive 4-digit integers that can be formed where each digit is in set T and the 4 digits in each 4-digit integer are different from each other.

Quantity B: 7·6·5·4

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

（来源：考满分GRE数学机经200题第四套-Section2-3-Easy）

排列问题：拆分法

16. A knockoff website requires users to create a password using letters from the word MAGOSH. If each password must have at least 4 letters and no repeated letters are allowed, how many different passwords are possible?

（来源：考满分 GRE 数学机经 170 题-122-Medium）

17. How many positive integers less than 10,000 are such that the product of their digits is 210?

A. 24

B. 30

C. 48

D. 54

E. 72

（来源：考满分 GRE 数学机经 170 题-126-Medium）

组合问题

18. In how many ways can a 5-person committee can be formed out of 6 professors, 3 managers and 4 coordinators such that Dr. W, one of the professors, and Ms. M, one of the managers, are both selected?

（来源：考满分数学机经题2018-12-22-Medium）

19. From a group of 8 people, it is possible to create exactly 56 different k-person committees. Which of the following could be the value of k ?

Indicate *all* such values.

A. 1

B. 2

C. 3

D. 4

E. 5

F. 6

G. 7

（来源：考满分 GRE 数学机经 170 题-121-Medium）

组合问题：拆分法

20. How many three-digit integers between 100 and 900, inclusive, are out there where the sum of their first two digits and last two digits are both 7?

（来源：最新机经题2018-10-26-Medium）

21. Tom has to randomly choose 4 people out of 2 boys and 5 girls such that at least 1 boy and 1 girl are selected. In how many ways can they be selected?

（来源：最新机经题2018-09-28-Medium）

22. How many even double-digit integers can be formed out of six integers from 1 to 6 such that no repeated numbers are used?

（来源：最新机经题2018-09-28-Medium）

23. Five identical balls need to be put into three different boxes. At least one ball should be included in each box. How many ways can these balls be arranged?

（来源：最新机经题2018-11-23-Medium）

24. How many positive integers can be expressed as a product of two or more of the prime numbers 5, 7, 11, and 13 if no one product is to include the same prime factor more than once?

A. Eight

B. Nine

C. Ten

D. Eleven

E. Twelve

（来源：考满分 GRE 数学机经 170 题-160-Medium）

25. A reading list for a humanities course consists of 10 books, of which 4 are biographies and the rest are novels. Each student is required to read a selection of 4 books form the list, including 2 or more biographies. How many selections of 4 books satisfy the requirements?

A. 90

B. 115

C. 130

D. 144

E. 195

（来源：考满分 GRE 数学机经 200 题-Medium）

26. There are 4 fiction books and 6 non-fiction ones, while 3 of the non-fiction are biographies. Now choose 3 books from the total 10 books. What is the probability of at least one fiction and no more than 1 biography are selected?

（来源：考满分数学最新机经题2018-12-02-Hard）

排列组合问题&拆分&乘法原理

27. In a kindergarten, three shorter kids sit in the first row, while four taller ones sit in the second row. In how many ways can they be arranged?

（来源：考满分数学机经题2018-10-26-Easy）

28. A, B, C, D, E need to take seats such that either A or B needs to sit at first or at last. How many ways can they sit together?

（来源：考满分数学机经题2018-10-21-Medium）

29. How many different five-digit even integers can be formed out of 1, 2, 3, 4 and 5 such that none are selected for more than once?

（来源：考满分数学机经题2018-12-22-Easy）

30. How many 6-digit integers greater than 400,000 can be formed such that each of the digits 2, 3, 4, 5, 6 and 7 is used once in each 6-digit integer?

A. 240

B. 480

C. 720

D. 960

E. 1440

（来源：考满分GRE数学机经200题第五套-section2-17-Medium）

31. How many three-digit integers can be formed out of 8 different integers (5 odd ones, 3 even ones) so that the tens and hundreds digit are both odd integers, while the units digit is an even integer (no integers could be used by more than once)?

（来源：考满分数学机经题2018-12-02-Medium）

32. C and M have to take pictures together with five other people. C has to stand in one of the three positions in the middle, M has to stand besides C, while the other five people can stand as they want. In how many ways can they stand in total?

（来源：考满分数学机经题2018-10-12/2019-01-27-Medium）

33. Five gift cards (one 100-dollar card, one 50-dollar card, one 25-dollar card and two 10-dollar card) have to be assigned to ten kids such that each kid receives no more than one card. In how many ways can these five cards be distributed?

（来源：考满分数学机经题2018-10-12-Hard）

排列组合问题：拆步相乘法

34. To set a three-letter password for a website, a person selects two letters from the 26 alphabet and use one letter twice. How many different passwords are possible?
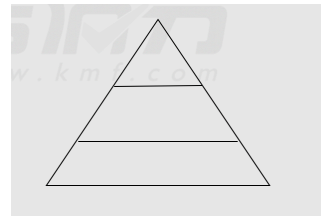
（来源：考满分数学机经题2018-11-03-Hard）

35. Mark is supposed to fill three sectors of a garden with a selection of five colors of flowers. The same color could be used, but only twice at most, and not adjacent. In how many ways can the garden be decorated?

（来源：考满分最新机经题2018-11-23-Hard）

捆绑法

36. In how many different ways can 3 boys and 3 girls be seated in a row of 6 chairs such that the girls are not separated, and the boys are not separated?

A. 24

B. 36

C. 72

D. 144

E. 288

（来源：考满分 GRE 数学机经 170 题-119-Hard）

37. In how many ways can three couples sit in a row such that each couple sit together?

38. How many ways can 7 different books (2 history books, 3 geography books, 2 philosophy books) be arranged on a three-tier bookshelf such that books from the same subject are put together on the same tier?

插空法

39. Sid intended to type a seven-digit number, but the two "3" he meant to type did not appear. What appeared instead was the five-digit number 52115. How many different seven-digit numbers could Sid have meant to type?

A. 10

B. 16

C. 21

D. 24

E. 27

40. A fair coin is tossed 6 times. What is the probability of getting no any two heads on consecutive tosses?

A. 21/64

B. 42/64

C. 19/64

D. 19/42

E. 31/64

选空法

41. How many integers between 1 and 10^{21} are such that the sum of their digits is 2?

A. 190

B. 210

C. 211

D. 230

E. 231

（来源：考满分 GRE 数学机经 170 题-124-Medium）

42. How many points (r, s) can be formed so that r<s, and that the x and y-coordinates of the point are both selected from odd integers between 1 and 399, inclusive?

（来源：考满分数学机经题2018-12-22-Medium）

倒减法

43. Four guests A, B, C and D have to be assigned into three different rooms (one double room and two single rooms) such that A and B won't have to stay in the double room at the same time. How many ways in total can they be assigned into these rooms?

（来源：考满分数学机经题2018-09-28-Medium）

44. Linda has 4 jackets, 3 pants and 2 pairs of shoes. She could choose 1 jacket, 1 pant and 1 pair of shoes every day. However, 1 jacket and 1 pant don't match, so they cannot be selected together. In such circumstance, for how many days can she wears differently?

（来源：考满分数学机经题2018-12-02-Medium）

倒除法

45. 40 DVDs (17 are about psychology, 14 are about biology, and 9 are about history) need to be arranged in a bookshelf such that the 9 history-related DVDs are, on the whole, arranged in chronological order. How many ways can these DVDs be arranged?

A. (17!)(14!)(3!)

B. (17!)(14!)(9!)

C. (17!)(14!)(9!)(39)

D. (40!) / (9!)

E. 32!

（来源： GRE 数学最新最快最全机经 600 题（三）21：Hard）

46. A password is formed by 5 special characters, including an "@", two "$" and two "#". How many different passwords can be formed?

（来源：GRE 数学最新最快最全机经 600 题（三）190：Hard）

追根溯源法

47. In how many different ways can 3 identical green shirts and 3 identical red shirts be distributed among 6 children such that each child receives a shirt?

A. 20

B. 40

C. 216

D. 720

E. 729

（来源：考满分 GRE 数学机经 170 题-123-Hard）

48. In how many ways can 4 kids (2 boys and 2 girls) be selected out of 5 couples of boy-girl twins such that no kids are selected from the same couple?

（来源：考满分数学机经题2018-12-22-Hard）

握手问题

49. **Quantity A:** The number different line segments that can be formed when connecting 6 different points on a circle

Quantity B: 15

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

（来源：满分数学机经题2018-12-02-Hard）

50. 7 kids play poker games together, and every two kids play five rounds to determine who wins. How many rounds do they need to play so that every kid plays with all the other kids?

（来源：考满分数学机经题2018-12-22-Hard）

51. Each person at a party shook hands exactly once with each of the other people at the party. There was a total of 21 handshakes exchanged at the party.

Quantity A: The number of people at the party

Quantity B: 8

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

（来源：考满分数学机经题2018-12-22-Hard）

52. There are 10 people in a room. If each person shakes hands with exactly 3 other people, what is the total number of handshakes?

A. 15

B. 30

C. 45

D. 60

E. 120

（来源：考满分 GRE 数学机经 170 题-20-Hard）

53. In a soccer league, if there were 10 teams and each team played with each of the other team 16 times, then how many games each team play?

（来源：考满分 GRE 数学机经 2018-12-22-Easy）

2.6 概率 Probability

[知识点总览]

Probability is a way of describing uncertainty in numerical terms. In this section we review some of the terminology used in elementary probability theory.

A **probability experiment**, also called a **random experiment**, is an experiment for which the result, or **outcome**, is uncertain. We assume that all of the possible out- comes of an experiment are known before the experiment is performed, but which outcome will actually occur is unknown. The set of all possible outcomes of a random experiment is called the **sample space**, and any particular set of outcomes is called an **event**. For example, consider a cube with faces numbered 1 to 6, called a 6-sided die. Rolling the die once is an experiment in which there are 6 possible outcomes— either 1, 2, 3, 4, 5, or 6 will appear on the top face. The sample space for this experiment is the set of numbers 1, 2, 3, 4, 5, and 6. Two examples of events for this experiment are (i) rolling the number 4, which has only one outcome, and (ii) rolling an odd number, which has three outcomes.

The **probability** of an event is a number from 0 to 1, inclusive, that indicates the likelihood that the event occurs when the experiment is performed. The greater the number, the more likely the event.

Classical Probability: In general, for a random experiment with a finite number of possible outcomes, if each outcome is equally likely to occur, then the probability that an event E occurs is defined by the ratio

$$P(E) = \frac{\text{the number of outcomes in the event } E}{\text{the number of possible outcomes in the experiment}}$$

The following are general facts about probability.

- If an event E is certain to **occur**, then P(E) = 1.

- If an event E is certain **not to occur**, then P(E) = 0.

- If an event E is possible but not certain to occur, then **0 < P(E) < 1.**

- **The probability that an event E will not occur is equal to 1 − P(E).**

- If E is an event, then the probability of E is the sum of the probabilities of the outcomes in E.

- **The sum of the probabilities of all possible outcomes of an experiment is 1.**

If E and F are two events of an experiment, we consider two other events related to E and F.

- **The event that both E and F occur, that is, all outcomes in the set E ∩ F.**

- **The event that E or F, or both, occur, that is, all outcomes in the set E ∪ F.**

Events that cannot occur at the same time are said to be **mutually exclusive**. For example, if a 6-sided die is

rolled once, the event of rolling an odd number and the event of rolling an even number are mutually exclusive. But rolling a 4 and rolling an even number are not mutually exclusive, since 4 is an outcome that is common to both events.

For events E and F, we have the following rules.

- **P (E or F, or both, occur) = P(E) + P(F) − P(both E and F occur),** which is the **inclusion‑exclusion principle applied to probability.**

- **If E and F are mutually exclusive**, then **P (both E and F occur) = 0**, and therefore, **P (E or F, or both, occur) = P(E) + P(F).**

- E and F are said to be independent if the occurrence of either event does not affect the occurrence of the other. **If two events E and F are independent, then P(both E and F occur) = P(E)P(F).**

It is common to use the shorter notation "**E and F**" instead of "**both E and F occur**" and use "**E or F**" instead of "**E or F, or both, occur.**" With this notation, we have the following rules.

- P(E or F)=P(E)+P(F)−P(E and F)

- P(E or F) = P(E) + P(F) if E and F are **mutually exclusive**.

- P(E and F) = P(E)P(F) if E and F are **independent**.

[相关术语]

- probability experiment 概率实验

- random experiment 随机试验

- sample space 样本空间

- event 事件

- probability 概率

- random selection 随机挑选

- classical probability 古典概率

- mutually exclusive 互斥事件

- complementary events 对立事件

- independent event 相互独立事件

- inclusion‑exclusion principle applied to probability 概率中的容斥原理

[核心考点]

1）古典概率=所求可能性事件个数/总可能性事件个数

2）概率中的容斥原理

- P(A or B)=P(A)+P(B)-P(A and B)

3）互斥事件的概率公式

- P(A and B)=0

- P(A or B)=P(A)+P(B)

4）对立事件的概率公式

- P(A and B)=0

- P(A or B)=P(A)+P(B)=1

5）相互独立事件的概率公式

- P(A and B)=P(A)·P(B)

- P(A or B)=P(A)+P(B)- P(A)·P(B)

6）概率问题的潜在定义域

- 任何事件的概率≤1

6）两个事件 A\B 关系未明确时，AB 都发生/A 或 B 发生的概率最大最小值的求法：假设 P(A)>P(B)

A	B	P(A and B)	P(A or B)
A 与 B 互斥时		取到最小值：0	取到最大值：P(A)+P(B)
A 与 B 相交时		P(A and B)	P(A)+P(B)-P(A and B)
A 与 B 相互独立时		P(A)·P(B)	P(A)+P(B)-P(A)·P(B)
A 包含 B 时（B 是 A 的子事件）		取到最大值：P(B)	取到最小值：P(A)

[专项练习]

（建议用时：40min）

测试用时	正确率	错题编号
/min	/30	

古典概率/等可能性事件

1. A jar contains exactly 10 dimes and x quarters and no other coins. If a coin is randomly selected from the jar, the probability that a quarter is selected is 0.6. What is the value of x.

A. 5

B. 6

C. 8

D.12

E. 15

（来源：考满分GRE数学机经200题第一套-Section1-9-Easy）

2. If one number is chosen at random from the first 1,000 positive integers, what is the probability that the number chosen is a multiple of both 2 and 8?

A. 1/125

B. 1/8

C. 1/2

D. 9/16

E. 5/8

（来源：考满分 GRE 数学机经 170 题-157-Easy）

3. A person randomly selects a number from 1, 2, 3, 4, 5, 6. What is the probability that the selected number is either greater than 3, or even, or both?

（来源：考满分数学机经题2018-10-21-Easy）

4. If two numbers are randomly selected from positive integers from 1 to 10 such that no number is selected

twice, what is the probability that the difference of the two selected numbers is 1?

（来源：考满分数学机经题 2018-12-14-Easy）

5. If 9 out of 15 dancing programmes are new, then what's the probability that the two programmes randomly selected from them are both new ones?

（来源：考满分数学机经题2018-10-21-Easy）

6. Of the 20 lightbulbs in a box, 2 are defective. An inspector will select 2 lightbulbs simultaneously and at random from the box. What is the probability that neither of the lightbulbs selected will be defective? Give your answer as a ***fraction.***

（来源：考满分 GRE 数学机经 170 题-28-Medium）

7. A committee has to choose four out of ten companies (C_1 and C_2 included) for the annual award. What is the probability that C_1 and C_2 are both selected?

（来源：考满分数学机经题 2018-11-18-Medium）

8. What is the probability that A and B are both selected when you select 40 people out of a group of 100 (A and B included)?

（来源：考满分数学机经题 2019-01-04-Medium）

9. A box at a yard sale contains 3 different china dinner sets, each consisting of 5 plates. A customer will randomly select 2 plates to check for defects. What is the probability that the 2 plates selected will be from the same dinner set?

A. 2/7

B. 2/5

C. 2/3

D. 5/6

E. 3/2

（来源：考满分GRE数学机经200题第二套-section2-9-Medium）

10. In a bag, only red and blue balls (at least 2 balls for each color) are included.

Quantity A: The probability that red ball is selected when you add a blue ball from the box

Quantity B: The probability that red ball is selected when you remove a red ball from the box

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

（来源：考满分数学机经题 2019-01-04-Medium）

11. What is the probability that the one 3-digit and one 2-digit integers that could be formed out of 1, 2, 3, 4 and 5 (each figure is used for only once) are both even integers?

（来源：考满分数学机经题 2018-12-22-Hard）

12. Mark flips 2 dimes (10 cents each) and 1 nickel (5 cents) together for twice. What is the probability that the total value of coins on the heads is 15 cents?

（来源：考满分数学机经题 2018-12-22-Hard）

古典概率&几何

13. Eight points are equally spaced on a circle. If 4 of the 8 points are to be chosen at random, what is the probability that a quadrilateral having the 4 points chosen as vertices will be a square?

A. 1/70

B. 1/35

C. 1/7

D. 1/4

E. 1/2

14. In a plane, points P and Q are 20 inches apart. If point R is randomly chosen from all the points in the plane that are 20 inches from P, what is the probability that R is closer to P than it is to Q ?

A. 0

B. 1/4

C. 1/3

D. 1/2

E. 2/3

15. If points A and B are randomly placed on the circumference of a circle with radius 2, what is the probability that the length of chord AB is greater than 2?

A. 1/4

B. 1/3

C. 1/2

D. 2/3

E. 3/4

互斥事件/对立事件

16. p is the probability that event E will occur, and s is the probability that event E will not occur.

Quantity A: p+s

Quantity B: ps

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

独立事件

17. A certain box contains 4 red blocks, 5 blue blocks, and 3 yellow blocks. Judy will select one of these blocks

at random from the box, put it back in the box, and then again select a block at random from the box. What is the probability that both of the blocks selected will be yellow?

Give your answer as a *__fraction__*.

18. Set A: {71,73,79,83,87}

Set B: {57,59,61,67}

If one number is selected at random from set A, and one number is selected at random from set B, what is the probability that both numbers are prime?

A. 9/20

B. 3/5

C. 3/4

D. 4/5

E. 1

19. 20 boys and 40 girls are in Group A, while at least 7 boys, together with some girls are in Group B. To choose one person from each of the group, the probability that both are boys is no greater than 1/15. Which of the following statements must be true?

Indicate *__all__* such statements.

A. The number of people in group B is greater than 34.

B. The number of girls in group B is greater than 32.

C. The number of girl in group B is less than 34.

20. A and B are independent events, and the probability that both events occur is 1/2. Which of the following could be the probability that event A occurs?

Indicate *__all__* such probabilities.

A. 0

B. 1/4

C. 1/2

D. 3/4

E. 1

（来源：考满分 GRE 数学机经 170 题-75-Medium）

21. Events A and B are independent.

The probability that events A and B both occur is 0.6

Quantity A: The probability that event A occurs

Quantity B: 0.3

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

（来源：考满分 GRE 数学机经 170 题-112-Medium）

22. A box contains 10 balls numbered from 1 to 10 inclusive. If Ann removes a ball at random and replaces it, and then Jane removes a ball at random, what is the probability that both women removed the same ball?

A. 1/100

B. 1/90

C. 1/45

D. 1/10

E. 41/45

（来源：考满分 GRE 数学机经 170 题-113-Medium）

23. There are only similar number of red and green balls in a box. A person first randomly selects a ball from the box without replacement, and continues to select another ball. Which of the following probability is 1/2?

Indicate *all* that are true.

A. The first ball is green

B. The second ball is green

C. Only one of the two balls selected is green

（来源：考满分数学机经题2018-10-12-Hard）

独立事件&对立事件

24. In a probability experiment, G and H are independent events. The probability that G will occur is r, and the

probability that H will occur is s, where both r and s are greater than 0.

Quantity A: The probability that either G will occur or H will occur, but not both

Quantity B: r+s-r×s

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

（来源：考满分 GRE 数学机经 170 题-38-Hard）

25. The probability that a component fails during first use is 0.1. If the component doesn't fail during first use, then the probability that the component won't fail in the following six months is 0.8

Quantity A: The probability that the component won't fail within six months

Quantity B: 0.75

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

（来源：考满分数学机经题2018-10-21-Hard）

26. Among 5 different red envelopes, 2 include cash, 3 include gifts. If you choose two red envelopes without replacement, what is the probability that cash is selected at least once?

（来源：考满分数学机经题2019-01-04-Hard）

27. In a box, the probability that the red ball is selected is 5/8. Mark randomly selects balls twice from the box without replacement. If he didn't get a red ball in the first attempt, then the probability that he gets a red ball in the second attempt is 2/3. What is the probability that Mark get at least one red ball?

（来源：考满分数学机经题2018-12-14-Hard）

28. In seven continuous tosses, Event X or Event Y appears randomly each time. If Event X appear first, then

Event X appears the next time is 0.3. If Event Y appears first, then Event Y appears the next time is 0.4. If Event X appears in the fifth time, then what is the probability that Event X appears in the seventh time?

（来源：考满分数学机经题2018-12-14-Hard）

最小抽取次数题问题

29. In a certain sock drawer, there are 4 pairs of black socks, 3 pairs of gray socks and 2 pairs of orange socks. If socks are removed at random without replacement, what is the minimum number of socks that must be removed in order to ensure that two socks of the same color have been removed?

A. 4

B. 7

C. 9

D. 10

E. 11

（来源：考满分 GRE 数学机经 170 题-20-Medium）

30. Ben has 30 pencils in a box. Each of the pencils is one of 5 different colors, and there are 6 pencils of each color. If Ben selects pencils one at a time from the box without being able to see the pencils, what is the minimum number of pencils that he must select in order to ensure that he selects at least 2 pencils of each color?

A. 24

B. 25

C. 26

D. 27

E. 28

（来源：考满分GRE数学机经200题第三套-Section2-10-Medium）