

Worksheet for CS161

- 1) A new company with 2 employees rents a building with 12 offices. How many ways to assign the different offices to these 2 employees is there?

$12 \cdot 11$

- 2) The chairs of an auditorium are to be labeled with an uppercase English letter followed by a positive integer not exceeding 100. What is the largest number of chairs that can be labeled differently?

$26 \cdot 100$

- 3) There are 32 microcomputers in a computer center. Each microcomputer has 24 ports. How many different ports to a microcomputer in the center are there?

$32 \cdot 24$

- 4) Counting Functions. How many functions are there from a set with m elements to a set of n elements?

n^m

- 5) Counting one-to-one functions. How many one-to-one functions are there from a set of m elements to a set of n elements?

When $m > n$, there are no one-to-one functions from a set of m to a set of n .

If $m \leq n$, there are $n!/(n-m)!$

- 6) Suppose that either a member of the math faculty or a student who is a math major is chosen to represent the math department on a committee. How many different choices are there, if there are 37 members of the math faculty and 83 math majors and no one is both a faculty and a student?

120 choices.

7) How many bit strings of length 8 can start with either a 1 bit or end with two bits 00?

$$2^7 + 2^6 - 2^5$$

8) A computer company receives 350 applications from computer graduates for a job. 220 of these applicants majored in computer science, 147 majored in business, and 51 majored in computer science and business. How many of these applicants majored neither in computer science nor in business?

$$220 + 147 - 51 = 316$$

$$350 - 316 = 34$$

9) How many words does it take before there are two words that start with the same letter?

27

10) How many students must be in a class to guarantee that at least 2 students receive the same score on the final exam, if the exam is graded on a scale 0 to 100.

102 (101 possible scores)

11) At Sunnydale High School there are:

- _ 55 students in either algebra, biology, or chemistry class
- _ 28 students in algebra class
- _ 30 students in biology class
- _ 24 students in chemistry class
- _ 8 students in both algebra and biology
- _ 16 students in both biology and chemistry
- _ 5 students in both algebra and chemistry

How many students are in all three classes?

There are 2 students in all three classes.

82 class enrollment

29 students double counted

53 students. Since there are 55 students, 2 of them must be in all 3 classes (i.e. subtracted from the double counting).

For the following set of problems assume there are 26 letters [a-z], 10 digits [0-9]. User names start with a person's first initial and last initial (a letter), followed by a set of letters and numbers. Passwords contain strings of letters and numbers. Characters are defined as either letters or numbers. For each case, identify the rule(s) used.

12) How many 5 character user names are there?

$26^2 * 36^3$ – product rule

13) How many 5 or 6 character user names are there?

$26^2 * 36^3 + 26^2 * 36^4$ - product & sum

14) How many 3 character passwords are there?

36^3 - product rule

15) How many 3 character passwords are there where all three are letters?

26^3 – product rule

16) How many passwords of 3 characters where at least 1 character is a digit?

$36^3 - 26^3$ product rule and incl/excl

The product of the possible passwords – the product of passwords that are only letters.

17) How many passwords of 3 characters are there where at least 1, 2, or 3 characters are digits?

Same as above.

18) How many passwords of 3 characters are there where 2 or 3 characters are digits?

$36^3 - 26^3 - 3 * 10 * 26^2$ or $3 * 10^2 * 26 + 10^3$

19) How many 4 character passwords are needed such that 2 of them start with the same character?

37 – pigeon

20) How many 4 character user names are needed such that 2 of them start with the same initials?

$26 \cdot 26 + 1$ (pigeon and product)

21) How many 4 character user names can be created with the same set of initials?

$36 \cdot 36$ (pigeon and product)

22) How many user name/password combinations are there with 3 characters in each?

$26^2 \cdot 36^4$ – product and product

23) How many functions are there between a set with a cardinality of 5 and a set with a cardinality of 8.

8^5 - product

24) How many one-to-one functions are there between a set with a cardinality of 5 and a set with a cardinality of 8?

$8 \cdot 7 \cdot 6 \cdot 5 \cdot 4$ or $8!/3!$ - product

25) How many one-to-one functions are there between a set with a cardinality of 8 and a set with a cardinality of 5?

None