



Instructions:

- Your team has 75 minutes to solve as many of the 20 problems below as possible. It is NOT expected that you will solve all, or even most, of the problems in 75 minutes.
- Feel free to use any language, Google, and any web resources you might find
- These questions may not be sorted in order of difficulty.
- One point will be given for each correct answer. Solve easier questions first!
- Some problems require a dataset. References to files will be marked as [filename] which will refer to a file in the .zip archive shared via Google Drive at goo.gl/EjphgX (link is case sensitive.)
- Note: The goal is to find the answers to the questions. You may or may not want to write code to do so.

Submit answers at ggpuzzles.appspot.com - make sure you are under the coding challenge and submitting for the correct problem!

Credits:

- wordlist is a modified version of a commonly used scrabble word list
- The spaceless book is a modified version of "The Tale of Peter Rabbit" by Beatrix Potter (now in the public domain!)
- The list of stock tickers is taken from www.nasdaq.com
- The quote for simple cyphers is a modified version of a quote from Larry Page
- Pokemon is owned by The Pokemon Company

For organizational purposes ONLY, here is a table you can use to keep track of your team's progress.

REMEMBER: You must submit answers at ggpuzzles.appspot.com - make sure you are under the coding challenge and submitting for the correct problem!

#	Title	Answer
1	Sieve Starters	
2	"Base"ic Sorting	
3	Googol Powers	
4	Duplicate Files	
5	"Fashion" Sense	
6	Phony Stocks	
7	Simple Ciphers	
8	Alphabet Soup	
9	All Tied Up	
10	Snowfield	
11	Shiritori Strings	
12	Ender's Game	
13	Alien Alphabet	
14	Word Groups	
15	Spaceless Books	
16	SPAAAAACE!	
17	Subway Woes	
18	Beautiful Sushi	
19	Chutes and More Chutes	
20	Gotta Collect 'em All!	

Problem 1: Sieve Starters

One of our engineers is working on finding prime numbers. As a first approach, they would like to make a sieve of Eratosthenes, but they aren't sure it's working right.

To test it, they have taken the numbers from 2 to 1000000 inclusive, removed all the multiples of 2, 3, 5, and 7, and summed the remaining numbers. They would like to verify that their answer matches yours.

What is the sum of the numbers from 2 to 1000000 that are not multiples of 2, 3, 5, or 7?

Problem 2: "Basic" Sorting

Another of our engineers is exploring number distributions in different bases. To support their work, they have a program that does the following:

- Takes a hex number
- Converts that number to all the bases from 15 to 2 inclusive, and appends them to the hex number
- Determines which digits appear in that string most often
- Converts the string into a string of the digits in order of most common to least common, then from highest to lowest, that appear at least once

For example,

$(0x)64 \rightarrow '646a727984911001211442022444001210102011100100' \rightarrow '1042976a8'$

What is the final string for the starting number (in hex) 0x12345 (i.e. 74565 in decimal)? For example, the final string for 0x64 is '1042976a8'

1	1	A	1
2	14	B	0
3	11	C	1
4	5	D	1
5	8	E	0
6	3	F	0
7	5	G	24
8	X0	H	0
9	Z2	I	0

~~Problem 3: Googol Powers~~

Google's name was derived from the word "googol", which is a word for the number 10^{100} .

Powers of two are very important in programming.

Find the sum of the digits of the first power of two greater than 10^{100} .

For example, for the first power of two greater than 10^2 , the number is 128, and the sum of the digits is 11.

Problem 4: Duplicate Files

One day a Google engineer was looking at files stored for their team's project, and found that there were a lot of duplicate files. The engineer wrote a method to count unique files in a directory, but would like to verify their work.

For our purposes, a duplicate file is one with the same md5 hash and file size. [file_data] contains a list of 10000 md5 hashes and file sizes. Please find how many different files there are.

Problem 5: "Fashion" Sense

Some of our engineers want to know how many pairs of color matching clothes they possess. So they want some software to help. You will get a file containing color values for 100 pairs of pants and 100 shirts. The colors will be defined as HSL values, Hue as a number of degrees on a circle from 0-360, Saturation as a value from 0-100, and Light as a value from 0-100. Clothes are considered matching if difference between the saturation and light of the two clothes are 10 or less, and the differences between the hue values are between 110-130, 170-190, or 230-250 of each other (inclusive). Clothes data is in **[clothes]**

Note that hue is a number of degrees on a circle, so 5 and 355 are 350 away from each other, but also 10 away from each other.

Calculate how many matching pairs of clothes the engineers have.

(Warning: We accept no responsibility for actually trying to match clothes this way)

Problem 6: Phony Stocks

A friend is starting a telephone service where people can call in and get the prices of stocks. Your friend is curious to know how many of the stocks on the NY stock exchange can be uniquely dialed on a phone.

A list of all the stock tickers on the NYSE is in [[stocks](#)]

Here is a picture of a telephone touch pad.



For example, if you wanted to dial ALLF, you would dial “2553”. However, since there is also an ALLE stock, which is also dialed 2553, neither of these stocks can be uniquely dialed.

How many stocks in the file above can be uniquely dialed?

Problem 7: Simple Ciphers

I cyphered a text file I had using a substitution cipher (http://en.wikipedia.org/wiki/Substitution_cipher#Simple_substitution) but I lost my substitution key!

Could you decrypt the text for me?

The text is in the file named [cypher]. I don't want the graders to be able to read the whole text, so the answer is first five words in the decrypted text. I'll make arrangements to get the text later. Maybe

All of the words in the text are words in [wordlist]

Problem 8: Alphabet Soup

There is a type of puzzle where you are tasked with finding the longest word in a row of letters, but where one letter is a blank.

Here is an example:

TETUWCFMYALACUNA_ IANECFOB

There are several possible words:

TETUWCFMYALACUNA**B**IANECFOB

TETUWCFMYALACUNA**V**IANECFOB

But the best is actually:

TETUWCFMYA**L**ACUNA**R**IANECFOB

Given the list of words in [wordlist], find the best words for each of the words in [soup]. The answer is the sum of lengths of the optimal words. For example, if the above line were the only one in the file, the answer would be 9. Note that the blank must be a part of the word.

Problem 9: All Tied Up

Let's say you have a tic tac toe position:

XO.
X.O
.XO

...and you're interested in trying to find all the possible legal board configurations that end in a tie from this position. In this case there is only one, which is shown below (noting that X always moves first):

XOX
XXO
OXO

A list of positions can be found in [[tictactoe](#)]

The positions are laid out one per line, such that "123456789" would be laid out

123
456
789

For example, the position above would be listed as XO.X.O.XO

For each position, count the number of board positions that result in a tie given the original configuration. **The answer to this question is the sum of all these counts.** For example, if the above line were the only line in the file, the answer would be 1.

Problem 10: Snowfield

Two horizontal roads, one on the north, and one on the south, are separated by a grass field. Unfortunately, there is a lot of snow on the field.

The amount of snow on the field is represented in an x by y grid, with each number representing the number of units tall the snow is. The roads are represented by "XX".

We want to clear a path from one road to the other. A path is a set of squares that are connected up, down, left or right. A path is not able to connect via only touching corners. For example:

```
XX XX XX XX  
24 10 21 15  
18 10 25 10  
11 31 13 24  
XX XX XX XX
```

The bolded numbers represent a path between the two roads. To clear this path, we would have to move $10+10+18+11 = 49$ units of snow.

What is the minimum amount of snow (in units) we need to move to clear a path on the grid found in [snowfield] ?

11 30 19 15

Problem 11: Shiritori Strings

In Japan, there is a game called Shiritori. In this game, one player says a word, and the next player has to say a word that starts with the same letter that the first word ended with. You may not repeat words.

Some Pokemon fanatics wanted to try to play this game with Pokemon names. Unfortunately it's a bit too easy to win, so instead they want to figure out what the longest shiritori chain is.

Given a list of pokemon in [pokemon] find the longest possible shiritori chain. **The answer is the number of pokemon in the chain, and the pokemon that starts the chain, separated by a space.** For example, the chain below, if it were the answer, would be "5 FEAROW" (without the quotes)

For example, one chain is as follows:

FEAROW - WARTORTLE - EKANS - SPEAROW - WEEDLE (end of chain, there are no more pokemon that start with E in the list)

Problem 12: Ender's Game

Ender Wiggin is fighting against the space aliens. He has a special weapon that, when it hits an enemy ship, it creates an explosion with radius 100. If any ships are in that radius, they also explode, also with radius 100. This continues until no ships are within the radius of any exploding ships.

The coordinates of 2000 enemy ships, one x, y, and z coordinate per line, can be found in [\[ships\]](#)

If Ender can hit any single one of these two thousand ships, **what is the largest number of enemy ships he can destroy in one shot?**

Problem 13: Alien Alphabet

We have discovered artifacts of an alien race! And we are now trying to learn their language. We've found a way to convert the runes of their language to our alphabet, but we've realized that, after translation, their alphabet is not in the same order as ours.

You have a list of some of their words, in their lexicographic ordering. Your job is to rebuild the ordering of their alphabet from this list of words.

The list of alien words can be found in [\[alien\]](#)

What is the ordering of their alphabet? For example, if it were English, your answer would be "ABCDEFGHIJKLMNPQRSTUVWXYZ"

Problem 14: Word Groups

A word chain is a list of words such that each word is the same length as the previous word and differs only by one letter. For example: CHILE CHIME CHIMP CRIMP

A word group is a set of words such that any word in the group is reachable from any other via a word chain.

Given the list of words in **[wordlist]**, find the two largest disjoint groups of words, and provide their product as the answer (for example, if the two largest groups of words are 100 and 50 words large, the answer will be 5000)

Problem 15: Spaceless Books

Oh no! One of our Google Books engineers lost all of the spaces, lower casing, and punctuation in this book they were scanning.

Given the list of words in **[wordlist]** find the parsing of the spaceless book in **[book]** into these words that minimizes the number of characters that are in words not contained in the dictionary, and tell us how many characters that is. For example, if the book were:

ABCDEFGHIJKLMNPQRSTUVWXYZ

Using the words in **[wordlist]** we can split the book into words as follows

AB **C** DEF GHI **JKLM** NO PQR ST UVWXYZ

where the bold letters are words that are not in the dictionary. For this example, the answer would be 14.

Problem 16: SPAAAAACE!

The United Federation of Planets has established a number of space stations throughout the galaxy. They have just discovered a new technology that allows for instantaneous transport between two space stations, but in order to set up this technology a space ship must first fly between the two stations.

Assume that all space stations have ships that can fly to any other space station, and the cost of flying a ship between two stations is one credit per UFP distance unit, rounded up to the nearest credit.

You would like to establish this technology such that every station can be reached from every other station via this transport. It doesn't matter how many "transfers" are necessary to get from one station to the other, as long as the transporters can always be used. For example, if A is linked to B, and B is linked to C, D, and E, then A can reach every station via this transport.

The file **[stations]** contains the x, y, and z coordinates of all of the UFP's space stations in UFP distance units from an arbitrary point. **Find the minimum cost of linking all the space stations**

For example, if you had three stations like so:

A 0, 0, 0
B 100, 100, 100
C 200, 200, 300

The best linking is A-B and B-C. The cost of linking A to B is 174 credits, and the cost of linking B to C is 245 credits, so the total minimum cost is 419 credits.

Problem 17: Subway Woes

Buenos Aires has had a lot of strikes this year. This has made subway breakdowns much more likely than they've normally been, and the schedule is also much more variable than usual.

You've finally gotten on the subway, and you have 90 minutes to get to your first class. Your stop is 10 stops away. Getting to each stop takes an integer number of minutes between 2 and 5 inclusive, each number being equally likely. However, there is also a 20% chance per stop that the train will break down between stops. If it does, it will take an additional 21-40 minutes (also integer, inclusive, and each number equally likely) to fix the train and get to the next stop. The train may break down multiple times during the journey.

What is the percentage chance that you will make it to your stop, ten stops away, in 90 minutes or less? Your answer will be considered correct if it is within .0001%. Please omit the percentage sign when submitting your answer. For example, if we asked for the chance to make it one stop in 10 minutes or less, the answer would be "80.0000" (omitting the quotes)

1

2-5

10

~~20.0000~~

Problem 18: Beautiful Sushi

As a sushi chef, you must make sure your rolls are presented in an artistic way. You've determined that, when presenting pieces of your rolls on a plate, to be aesthetically pleasing they must follow these rules:

- Sushi must be arranged in rectangular groups
- The height of the rectangle must be equal or less than the width
- From left to right, the number of pieces in each group must not increase
- From left to right, the height of the group must not increase

For example, here are some valid configurations (3x6 representing height of 3 and width of 6): All of these configurations are for 24 pieces.

3x5, 2x4, 1x1
3x3, 2x3, 2x3, 1x3
3x8
4x5, 1x4

Here are some invalid configurations:

5x3, 3x3 (height cannot be greater than width)
2x3, 2x9 (number of pieces in each group must not increase)
2x4, 3x3, 1x7 (height of the group must not increase)

How many different ways are there to arrange a boat of 60 pieces of sushi? For example, there are 14 ways to arrange a boat of 6 pieces of sushi.

Problem 19: Chutes and More Chutes

You've made a children's game called "Chutes... and More Chutes." In this game, you start on space 0 and roll a fair six-sided die. If you roll 2-6, you move forward that number of spaces. If you roll a 1, however, you go all the way back to 0. The final square is square 30. If you overshoot the final square, you still win; for example, if you are on square 29 and roll a 6, you land on square 30.

How many turns would you expect a game to take a single player? Your answer will be considered correct if it is within .0001 of the correct answer. For example, if the final square was square 10, "4.16249" (without the quotes) would be an acceptable answer.

Problem 20: Gotta Collect 'em All!

One of your friends is a collector of Pokemon figures. A new set of figures is coming out today, and your friend wants to know how many to buy in order to “catch them all”.

You have a file which has a list of the probabilities of a particular box containing a particular figure, one probability per line.

The probabilities are in **[probabilities]**

What is the expected number of boxes that your friend will have to buy in order to get one of every figure? For example, if there were 10 different figures, all with a probability of .1, your friend would expect to have to buy 29.28968 boxes. Your answer will be accepted as correct if it is within .001 of the correct answer.