## Week 01

### Part 1 Morse De-Code

Welcome to your first day aboard the STS Space Ghost, where you’ll be venturing into the vastness of space for the very first time. After settling into your cabin, your next stop is to meet with the Officer on Deck who will provide you with your inaugural job assignment.

To your surprise, you find yourself entrusted with the important task of communications decoding in the Communications Bay, despite your limited experience in the field. Fortunately, a stroke of luck comes your way when you recall that a significant portion of space communication is conducted using Morse Code.

Although you’ve heard of Morse Code in passing, your understanding of it is a bit hazy. With a sense of urgency, you frantically search your desk drawer, and lo and behold! Serendipity leads you to a weathered booklet with yellowing pages with the title “Deciphering Morse Code”. Inside, you discover a comprehensive table containing Letter to Morse Code translations, along with a detailed guide on how your machine interprets the input code:

|  |  |
| --- | --- |
| * Letters in the words will be separated by spaces * Words will be separated by new lines (\n) * Dots (dits) will be represented with decimal characters (.) * Dashes (dahs) will be represented with underscore characters (\_) * Dots and dashes for each letter or character will not have spaces between them | |
| (morse code table) | This table shows the corresponding code for each letter or symbol with spaces between each dot or dash for ease of viewing. Remember, as per the rules of input, the actual input will not contain spaces between the dots and dashes for a single character.  ⭐︎ Additional symbols and numerical digits are not required for this challenge but can be included in your solution if you would like. |

### Part 2 Something Alien

Just as you translate the question received, another source has sent a reply. This must be the answer to the question previously asked, but the contents of the new message cause your script to error. This is not Morse Code. This looks instead like something alien.

Rather than panic and run to your supervisor, you set your mind toward solving this problem on your own. You re-read your Morse Code booklet to no avail and open your desk drawer to see if there might be anything else in there that could be of use… Nothing.

Sighing heavily and putting your head in your hands, you catch a glimpse of a poster on the wall beside your monitor which you hadn’t noticed before. It’s titled, “O.B.M.T. for Alien Communication” and it reads:

1. Convert each character to its Ordinal (Unicode code points)
2. Concatenate those numbers to one large integer, then convert that number to Binary
3. Convert the Binary number into Morse Code by considering the 0s dits and the 1s dahs.
4. Convert the Morse Code to Text

Underneath the fourth step there’s a footnote:

* Alien communication is always only one word. Each received alien transmission begins with three Exclamation Marks at the start and end of the message with an additional exclamation mark between each letter.

## Week 02

### Part 1 What a Mess!

You awake, ready to start a new day. Your holographic tablet dings, displaying a message:

Rise and shine, Cadet! Due to your exemplary performance in the Comm Bay, we are assigning you to the Electrical Control Room. Report there at 0800 hours.

When you arrive, the room is in chaos with the crew grabbing at piles of loose paper from the completely covered floor. The pages seem to be from an instruction manual of sorts. Someone sees you standing there and tells you to grab some paper and sort them, leaving before you can ask any questions. So, you grab a pile.

The sheets of printed paper do not have page numbers, but they all have a header printed at the top:

Section Title, Chapter Number, Subchapter Letter, Section Number

You decide to sort the pages like any book — first by chapter, then by subchapter, then by section. Each section sorted in ascending order.

When everyone is done sorting their piles, you assume you will have to work together to combine all your piles into one, so you decide to create a mnemonic out of the section titles to help you contribute to this collaboration.

### Part 2 BrailLED

Now that that’s all sorted, no pun intended, it’s time to get to work. The stress of this new assignment caused by the chaos of the paper storm has left you feeling like the Electric Control Room is not the place for you. You should put in a Change of Assignment request with the Operations Manager, but you’ve left your holographic tablet in your bunk. That’s ok because aboard the ship, all devices have the capability of communicating with the Operations Manager, provided there’s a screen to display the reply. Luckily for you, you’re stood in front of the “Binary Represented All-Inclusive Lettering LED” System, or “BrailLED” for short.

The BrailLED is long strip of LED lights with six rows and fifty-two columns. Transmissions are sent to the LED lights as a packet of tuples. The first item of the tuple is a binary string and the second is a column header. The columns are assigned from left to right the sorted uppercase letters A-Z followed by the sorted lowercase letters, a-z. The binary string fills its respective column from top to bottom, assigning the individual lights in that column ON for 1 or OFF for 0. The resulting LED display is a 2 row, 26 column strip of 3x2 light groupings, each grouping representing one letter in braille.   
Someone must have bumped the BrailLED amidst all the confusion this morning, because the inputs are not coming in sorted. You will have to sort the inputs first before letting the LED display show you your message in braille.

## Week 03

### Part 1 Stop, Dock, and Roll

Today you head to the Cargo Hold to start your next assignment. The room is brightly lit in a white light, and you can see thick tubes and chutes cris-crossing the walls and tall ceiling. Immediately center, you see a row of 40 giant capsule-filled tubes with an opening for each at the very top and at the front of the bottom, like upside-down PEZ dispensers. Beside this dispensing system, bolted to the floor is a large robotic arm, nearly as tall as the ceiling with spherical grips at the end of its long arm.

You’re greeted by the supervisor of the Cargo Hold, who has a kind voice and an even kinder smile. She explains to you what you need to do:

The spherical capsules inside these tubes are all different kinds of cargo. They are heavy metallic balls studded with rivets and embellishments. To tell them apart, most of the capsules are painted with a large bright red character (either alphabetical, or a punctuation symbol). The ones that lack any marking are all the same item, so it might be helpful to think of them as a space character rather than as nothing.

What’s inside them? She has no idea. She just gets a request from somewhere and runs the machine to fulfill it. Requests come on a piece of paper with two sections. The first line of the request is a number from 0 to 39 which indicates what dispenser to set the machine to start at. The next line on the paper is a long series of commands for the robotic arm, separated by commas. Each command either begins with a R, L, T, or D, followed by a number.

When the machine gets an R or an L command, the robotic arm moves its position either **Right** or **Left** the number of places indicated by the number. For example, “R3” would move the robotic arm 3 places to the right.

When the machine gets a T command, it **Takes** a capsule from the dispenser at its current position. The robotic arm pulls a single capsule from the dispenser, letting the remaining capsules descend to fill the empty space. That capsule is then vacuumed into an attached C-shaped tube where capsules are stored, always inserting itself into the front of the tube. For example, if the command is “T5”, the arm will take “A” from the current dispenser, then “B”, “C”, “D”, and “E”. Those capsules are stored in the tube in the order [E, D, C, B, A].

When the machine gets a “D” command, it **Drops** the specified number of capsules into the top of the dispenser it’s currently facing. Because of the C-shaped tube, capsules are dispensed from the opposite end of the tube, one at a time. For example, if the command is “D3” and the robot arm’s tube contains the [E, D, C, B, A] from before, it will drop “A” into the dispenser, then “B”, then “C”.

One last thing. The scanner is broken so you need to manually control the machine while following the instructions. Otherwise, she says, she could easily do this by herself, but now that you’re here, it will be a great help. Thank you very much. Once the order is complete, you press the “release” button and one capsule from each dispenser rolls out from the bottom, in order, onto the delivery cart to be shipped to the appropriate department of the ship.

### Part 2 Blunder Belt

Stop, stop, stop, stop! You see the supervisor running at full speed out of her office, frantically waving her arms. When she gets to you at the robot arm, she pauses to catch her breath, then tells you:

She’s forgot to tell you the most important step! Each time the robot arm receives a **T**ake command, after taking the correct number of capsules from the dispenser, you must push the “shift” button. This button activates a conveyor belt under all the dispensers, shifting their contents one space to the left. The contents of dispenser 12 are now in dispenser 11, the contents of dispenser 1 are now in dispenser 0, etc. The contents which were in dispenser 0 are now displaced all the way to the end at dispenser 39. The shift happens internally, and the robotic arm position is not affected by this change. If the arm’s position is 19, it remains 19 despite the contents of dispenser 19 changing. Nothing happens after commands for **R**ight, **L**eft, or **D**rop, only after **T**ake commands.

She pushes a big red reset button which empties the dispensers and fills them back up again with their predetermined order. Now you can start again, she says, and hands you a new command sheet.

## Week 04

### Part 1

It’s a new day on the STS Space Ghost and today you’re headed to the galley. That’s perfect—you could use a snack…

You meet the ship’s head chef who is deep in thought about the menu. Just as you’re about to mention that you could really go for a cheeseburger, he begins speaking to you, explaining what’s on his mind.

It turns out, the only food that the crew eats aboard the ship is Galactic Algae Blooms; a thought which slightly turns your stomach, but you hide your disgust well. There are five species of Galactic Algae Blooms: Sweet, Bitter, Umami, Salty, and Sour. The depth of flavor of each of these species varies from bloom to bloom, each individual one containing its own scores for both flavor complexity, persistence of taste, and intensity. A skilled chef can take these individual flavor profiles and create dishes which resemble many of the non-algae based dishes the crew are familiar with from home. The process is as follows:

-Gather algae from each of the required species:

You have to select three individual algae blooms, your puzzle input, and obtain each of their flavor profiles. Complexity of flavor is labeled x, so the three algae blooms you would use of a certain species have x1, x2, and x3. Persistence of taste is labeled y; y1, y2, and y3. Intensity of flavor has been cleverly labeled m for “Mmmmmmm”. Each algae bloom will have its own individual intensity, m1, m2, and m3.

-Seek out the Center of Flavor each species.

To determine the Center of Flavor of a species with three individual algae blooms, you use the common Center of Mass (cm) equations. <equations here> Finding the Center of Flavor at X and at Y will provide you with the Center of Flavor coordinates on the complexity-persistence graph. You will have a set of coordinates for each species used in the recipe.

-Lookup the values in the ASCII Recipe Cards.

Translating the numerical value of each coordinate to its ASCII value will provide you with two letters per species of Galactic Algae Blooms.

-Complete the recipe.

Taking the letters for all of the x coordinates in order and concatinating them with all of the letters for the y coordinates in order, separated by a space, will spell out the recipe item.

### Part 2

Now that we have a recipe in mind, it is time to gather the Galactic Algae Blooms from deep space. We do this using a deep space net. The chef shows you the control panel for the net, a big screen with glowing blobs in a gradient of color. These blobs, you are told, represent clusters of Galactic Algae Blooms. Pressing the toggle button will alternate between displaying the algae cluster blobs and a grid of numbers, your puzzle input, representing how many algae are at a given point.

The cost of casting this deep space net is very high, so you are informed you can only cast once per day. Luckily the algae blooms seem to migrate around each cluster’s center of mass, so casting a net directly into that location will collect every algae bloom from that cluster. Since the STS Space Ghost has a large crew, you should aim to collect as many algae blooms as you can.

In your previous equations for Center of Mass, you had only 3 points to consider, but these clusters of algae blooms are much more numerous. Unfortunately, the previous equation will not work, but you notice that you can perform the summations in the numerator and the denominator of the equations with any number of points. <equations here>

Type the x and y coordinates, separated with a comma, into the machine to cast the net to the cluster with the greatest total mass.

## Week 05

### Part 1

You performed so well in the galley that the crew in the generator room have requested your help today. They too are dealing with expensive instruments where precision and efficiency are paramount. Before you can get your hands on these new machines, they would like to give you a comprehension exam.

There is only one question on the exam, and it is a text map of spaces and # characters that look like a sort of cave of tunnels and chambers. The instructions are as follows:

If you have a water pump at the top-left entrance of the cave (position (0,0)), and you immediately begin to fill the cave with water, how many square meters of the cave will be flooded? In the map, each character or space represents a square meter. The # characters represent cave walls where water cannot pass through. For the purposes of this exercise, water can flow either up, down, left, or right, but not diagonally.

### Part 2

Having successfully passed the comprehension exam, you are admitted into the Laser Room. You see a gigantic machine, pointed out into space, with a rather simple control panel of a monitor, two large buttons, and dials for adjusting coordinates. The label on the machine reads “P.I.L.” which stands for “Pulsar Intercepting Laser”.

On the monitor, you see a map of pulsars that are within the laser’s range. <img>

You are briefed by the lead technician:

-The PIL will emit a frequency of light, in the direction of your provided coordinates, which hits the pulsar, causing it to flood out in all directions until it reaches an edge.

-This reaction, if present on the entire surface of the pulsar, will radiate 200 gigajoules (GJ) of energy, received by the PIL’s sensors.

-Unfortunately, a single pulse of the PIL costs 100 GJ to run, so the net energy gained from completely filling a pulsar is 100 GJ.

-If a pulsar is completely filled more than once, the PIL’s sensors are able to intercept 1100 GJ from it instead of 200 GJ. It does not matter if the pulsar is filled more than twice; it will only either emit 200 GJ for one fill or 1100 GJ for more than one.

-You are to think of the pulsar map as a 2D grid of pixels. Each of your coordinates targets a pixel on the map. Because of its two-dimensionality, the laser is interrupted by **any** edge, including both the outlines of other pulsars and the boundaries of the map.

Considering a smaller map and the four coordinates (66, 147) (120, 123) (329, 181) (368, 339), you try out this system. <img> There are two full pulsars colored (circled in red). The other yellow filled area does not count because the pulsar is not fully flooded.

Two full pulsars flooded only once provides 400 GJ of energy. But four coordinates cost 400 GJ of energy, making the net 0 GJ. This process does not seem as efficient as it could be. You open the metal cover on the side of the laser labeled "CALIBRATIONS" and inside you see a small mirror angled out of the lazer’s range. Moving that mirror into the laser’s path will double the output of the laser by mirroring the x and y coordinates!

## Week 06

### Part 1

Today’s assignment is in the Thermal Defense Room. This room serves as the ship’s primary defense against the unforgiving natural perils of space—extreme heat and harmful radiation.

In space, the ship is being constantly bombarded with waves of different frequency and wavelength. Some of these waves, Solar Waves, are damaging to the structure of the ship, where others, Comic Waves, are harmless.

The ship has a Thermal Defense system in place, but it works best when it is specifically targeted at harmful Solar Waves.

There is already a csv database on file which has recorded data about the individual frequencies and wavelengths of previously intercepted waves. However, some incoming waves have a combination of frequency and wavelength that has not yet been determined. Your job is to determine if these waves are harmful Solar Waves or harmless Cosmic Waves. To do so, you should find the 7 nearest known waves from the database. The so-called distance between waves is determined by graphing the coordinates with frequency representing the x axis and wavelength representing the y axis. The Euclidean Distance Formula is then used to gague how near or far one point is from another. The majority of the new wave’s neighbors will determine the type of that new wave.

Your puzzle input consists of a single line of new waves, with each wave represented by its frequency and wavelength separated by a comma, and individual waves separated by spaces. Following this line are several lines in a CSV format, which provide the database of known waves. In this CSV structure, the first column is "frequency", the second column is "wavelength", and the third column is "type".

### Part 2

## Week 07

### Part 1

### Part 2

## Week 08

### Part 1

### Part 2

## Week 09

### Part 1

### Part 2

## Week 10

### Part 1

### Part 2