

# Assignment 05

## An Infestation of Bees

Link:

<https://docs.google.com/document/d/19FC9iITJzKUlrhBK-Rsf2AmmwNwlqrDY13sSwV5VEW0/edit?usp=sharing>

Due: Friday, March 25th, 2022, at midnight, 100 points.

### Documentation Header Reminder

Before you start your assignment, you will need to add documentation similar to what we demonstrated in the first few lectures.

### Function Prototype Documentation Reminder

In the function prototype section of your C++ program, remember to add documentation to each function similar to what was demonstrated in lectures.

### Separate File Compilation

For this assignment (and onward), you will submit **multiple** C++ compilable files containing a program written in C++. Name your file a meaningful name and give it a proper extension (.h, .hpp, .cpp). Also, make sure that you compile and run your program using the GNU (g++) compiler before submitting to make sure that it will work.

### Background:

Recently, several countries have experienced outbreaks of bees. This is partially due to natural causes, and partially due to governments deploying airdrops of bees to countries in an effort to preserve bee populations. Unfortunately, when too many bees exist in an area, they spread out to nearby countries, and can even begin to mutate into things a little more terrifying.



# Assignment 05

## An Infestation of Bees

### Specifications

You will need to use a 2-dimensional array to represent the world. It should be a 10x10 array of characters. In this world, an underscore ('\_') shall be used to represent a country not currently infested with anything, a capital **B** shall be used to represent a country infested with bees, A capital **W** shall be used to represent a country infected with wasps, and a capital **T** shall be used to represent a country infested with tarantula hawk wasps.

Your program needs to be written so that it will take input from an input file, and write the output to an output file. In your input file, called "input.txt", there will first be 10 lines, each with 10 characters. These characters will be used to represent the initial state of the world. On the next several lines, there will be **two positive integers**. These numbers represent the coordinates that are about to be airdropped with bees. For example, if the next 3 lines of input.txt have the numbers 8 1, 0 9, and 4 4, then bees will be airdropped at coordinate positions **(8,1)**, **(0,9)**, and **(4,4)**. Here is a display of how your coordinate system should function:

0,0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	<b>0,9</b>
1,0	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	1,9
2,0	2,1	2,2	2,3	2,4	2,5	2,6	2,7	2,8	2,9
3,0	3,1	3,2	3,3	3,4	3,5	3,6	3,7	3,8	3,9
4,0	4,1	4,2	4,3	<b>4,4</b>	4,5	4,6	4,7	4,8	4,9
5,0	5,1	5,2	5,3	5,4	5,5	5,6	5,7	5,8	5,9
6,0	6,1	6,2	6,3	6,4	6,5	6,6	6,7	6,8	6,9
7,0	7,1	7,2	7,3	7,4	7,5	7,6	7,7	7,8	7,9
8,0	<b>8,1</b>	8,2	8,3	8,4	8,5	8,6	8,7	8,8	8,9
9,0	9,1	9,2	9,3	9,4	9,5	9,6	9,7	9,8	9,9

# Assignment 05

## An Infestation of Bees

## Airdropping

- If bees are airdropped into an empty country, that country will become infested with bees.

			Airdrop at->1,1				B			
--	--	--	-----------------	--	--	--	---	--	--	--

- If bees are airdropped into a country already infested with something, there will be an **outbreak** of whatever bug was already infesting that country. Every surrounding country will be **infested**.

				B	B	B
	B		Airdrop at->1,1	B	B	B
				B	B	B

				W	W	W
	W		Airdrop at $\rightarrow 1,1$	W	W	W
				W	W	W

				T	T	T
	T		Airdrop at->1,1	T	T	T
				T	T	T

# Assignment 05

## An Infestation of Bees

### Infesting

When countries have outbreaks, they have a possibility of infesting countries that are already dealing with an infestation. When this happens, a **mutation** may occur. Here are the possible scenarios:

If a bee infests a country already occupied by bees, they will mutate into **wasps**. Similarly, if a wasp infests a country already infested by wasps, they will mutate into **tarantula hawk wasps**. If a tarantula hawk wasp infests a country already infested by tarantula hawk wasps, no change will occur.

		B		B	B	W
	B		Airdrop at->1,1	B	B	B
				B	B	B

(An outbreak of bees occurred after bees were airdropped into the country at 1,1). Nearby countries were infested, and as the country to the north east was already occupied by bees, they mutated into wasps.)

		W		W	W	T
W	W		Airdrop at->1,1	T	W	W
				W	W	W

T		T		T	T	T
	T		Airdrop at->1,1	T	T	T
				T	T	T

If a bee attempts to infest a country already occupied by wasps or tarantula hawk wasps, they will be unsuccessful. Similarly, If wasps attempt to infest a country infested by tarantula hawk wasps, they will be unsuccessful.

# Assignment 05

## An Infestation of Bees

T	T	B		T	T	W
W	B	W	Airdrop at->1,1	W	B	W
T		T		T	B	T

(After an airdrop of bees at (1,1), the T's remained T's, and the W's remained W's. The bee infested country to the North-east mutated into wasps, and the country to the south received an infestation of bees.

T	T	T		T	T	T
T	W	T	Airdrop at->1,1	T	W	T
T	T	T		T	T	T

### Overall Program Flow

1. Read the first 10 lines of "input.txt" and set the values in a 2D array.
2. For every pair of integers after that in "input.txt", airdrop bees onto the corresponding location of the world.
3. Resolve any outbreaks and/or mutations that were caused by the airdrop.
4. Repeat airdropping until there are no coordinates left in input.txt
5. Output the final state of the world to a new file, called "output.txt"

### Other Notes

- You must use multiple files for this assignment.
- Be very careful to not try to assign values outside of your 10x10 array. You will get a segmentation fault error.
- You are encouraged to design and use your own functions to make the assignment easier.
- You may also use structs, however structs must go in their own .h file.
- Make your own test files! Try running the code with your own input.txt files to make sure it works as you expect it to.
- We do not care about anything that you output to the console, we will only check the contents of your output.txt file. If there is no file, your program will be considered to have no output at all.

# Assignment 05

## An Infestation of Bees

### Sample Output 1

(input.txt)

```
B_____TTB_  
_____TBB_  
_____BBB_  
___WWW_____  
___WTW_____  
___WWWTT___  
____T_T___  
_W___TTT___  
  
_____  
_____  
4 0  
0 0  
4 4  
1 7  
7 1  
6 6  
6 6  
0 0
```

# Assignment 05

## An Infestation of Bees

(This text in black is NOT part of the output, this is here to show the results of performing each airdrop.)

After (4,0):

B	—	—	—	—	—	T	T	B	—
—	—	—	—	—	—	T	B	B	—
—	—	—	—	—	—	B	B	B	—
—	—	—	W	W	W	—	—	—	—
B	—	—	W	T	W	—	—	—	—
—	—	—	W	W	W	T	T	—	—
—	—	—	—	—	T	—	T	—	—
—	W	—	—	—	T	T	T	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

(A bee was airdropped into (4,0))

After (0,0):

B	B	—	—	—	—	T	T	B	—
B	B	—	—	—	—	T	B	B	—
—	—	—	—	—	—	B	B	B	—
—	—	—	W	W	W	—	—	—	—
B	—	—	W	T	W	—	—	—	—
—	—	—	W	W	W	T	T	—	—
—	—	—	—	—	T	—	T	—	—
—	W	—	—	—	T	T	T	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

(A bee was airdropped into (0,0), causing an outbreak of bees into neighboring countries.)

# Assignment 05

## An Infestation of Bees

After (4,4):

B	B	—	—	—	—	T	T	B	—
B	B	—	—	—	—	T	B	B	—
—	—	—	—	—	—	B	B	B	—
—	—	—	T	T	T	—	—	—	—
B	—	—	T	T	T	—	—	—	—
—	—	—	T	T	T	T	T	—	—
—	—	—	—	—	T	—	T	—	—
—	W	—	—	—	T	T	T	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

(A bee was airdropped into (4,4), causing an outbreak of tarantula hawk wasps. Neighboring countries with wasps were mutated into tarantula hawk wasps.)

After (1,7):

B	B	—	—	—	—	T	T	W	—
B	B	—	—	—	—	T	B	W	—
—	—	—	—	—	—	W	W	W	—
—	—	—	T	T	T	—	—	—	—
B	—	—	T	T	T	—	—	—	—
—	—	—	T	T	T	T	T	—	—
—	—	—	—	—	T	—	T	—	—
—	W	—	—	—	T	T	T	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

(A bee was airdropped into (1,7), causing an outbreak of bees. Neighboring countries with bees were mutated into wasps, whereas neighboring countries with tarantula hawk wasps remained tarantula hawk wasps.)



# Assignment 05

## An Infestation of Bees

After (7,1):

B	B	—	—	—	—	T	T	W	—
B	B	—	—	—	—	T	B	W	—
—	—	—	—	—	—	W	W	W	—
—	—	—	T	T	T	—	—	—	—
B	—	—	T	T	T	—	—	—	—
—	—	—	T	T	T	T	T	—	—
W	W	W	—	—	T	—	T	—	—
W	W	W	—	—	T	T	T	—	—
W	W	W	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

(A bee was airdropped into (7,1), causing an outbreak of wasps.)

After (6,6):

B	B	—	—	—	—	T	T	W	—
B	B	—	—	—	—	T	B	W	—
—	—	—	—	—	—	W	W	W	—
—	—	—	T	T	T	—	—	—	—
B	—	—	T	T	T	—	—	—	—
—	—	—	T	T	T	T	T	—	—
W	W	W	—	—	T	B	T	—	—
W	W	W	—	—	T	T	T	—	—
W	W	W	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

(A bee was dropped into (6,6). No other effects occurred.)

# Assignment 05

## An Infestation of Bees

After (6,6):

B	B	—	—	—	—	T	T	W	—
B	B	—	—	—	—	T	B	W	—
—	—	—	—	—	—	W	W	W	—
—	—	—	T	T	T	—	—	—	—
B	—	—	T	T	T	—	—	—	—
—	—	—	T	T	T	T	T	—	—
W	W	W	—	—	T	B	T	—	—
W	W	W	—	—	T	T	T	—	—
W	W	W	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

(A bee was airdropped into (6,6), causing an outbreak of bees. No neighboring countries were affected as they are all infested with tarantula hawk wasps.

After (0,0):

B	W	—	—	—	—	T	T	W	—
W	W	—	—	—	—	T	B	W	—
—	—	—	—	—	—	W	W	W	—
—	—	—	T	T	T	—	—	—	—
B	—	—	T	T	T	—	—	—	—
—	—	—	T	T	T	T	T	—	—
W	W	W	—	—	T	B	T	—	—
W	W	W	—	—	T	T	T	—	—
W	W	W	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—

(A bee was airdropped into (0,0), causing an outbreak of bees. Neighboring countries with bees mutated into wasps.)

# Assignment 05

## An Infestation of Bees

(output.txt)

```
BW____TTW_  
WW____TBW_  
____WWW_  
____TTT____  
B__TTT____  
____TTTTT__  
WWW__TBT__  
WWW__TTT__  
WWW_____  
_____
```