Quest 12: One Spark to Burn Them All

Quest 11 Quest 13

Part I

Story section

After a long flight, the scout columns level out, signalling the end of the journey. You exchange friendly gestures, and the scouts fly off in all directions in search of the dragonducks. You are still high above, seeing many castles, cities, and villages. Suddenly, you spot something very strange.

A small castle at the base of the mountains, on the kingdom's far edge, glows in a similar way to the symbols and clues that only you could see. The pulsing repeats a sequence of long and short signals: `...---...`. You decide to check what it is.

As you fly closer, you spot clearings hidden in the forest, filled with barrels containing a greenish substance. In one of the clearings, a figure dressed like a nerdmaster is experimenting with the same substance in small cups. A knight, clad in armour as black as tar, is observing the procedure. Upon lighting the substance, an explosion ensues, propelling both the nerdmaster and the knight to the ground. They get back up, and you hear the knight congratulating the scholar, saying something about bringing the whole world to its knees very soon.

You remember seeing a similar substance after a sudden sneeze, but you believed it was just a cold and never considered that it could be explosive.

Suddenly, your eyes widen and everything becomes clear! As dragonducks are being held captive to collect this explosive material from them, the pulsing signal is their desperate call for rescue! You must save your family, but first you decide to burn as many barrels as you can to prevent them from being used by the knight.

You clench your beak and focus with all your might. Maybe you have more than just a brain for solving problems? You take a deep breath and... spit out a fireball! It might not be impressive, but it's definitely enough to ignite a single barrel. The fireball lands in a clearing near the knight, who immediately spots you in the sky and rushes to the castle. It's highly doubtful he has good intentions, so you need to hurry!

There are three clearings with the barrels arranged in rows and columns at fixed distances, forming grids. You note down the layout of the barrels in the clearing closest to you (your notes). You mark each barrel with a number corresponding to its size. The smallest barrels are marked as `1`, and the largest as `9`.

Your plan is very simple. You want to trigger a chain reaction by destroying just one barrel located in the top-left corner of the grid. You assume that each barrel, if ignited, can set fire to adjacent barrels on the left, right, top, and bottom that are smaller or the same size as the ignited one. The clearing is fairly small, so you can quickly verify your theory. You clench your beak again and aim your fireball at the chosen barrel.

Example based on the following notes:

```
989611
857782
746543
766789
```

The ignited barrel in the top-left corner destroys two neighbouring barrels, as it is larger.

```
989611
857782
746543
766789
```

Barrels ignited in this way destroy adjacent barrels of the same or smaller size.

```
989611  989611  989611  989611  989611  989611  989611      989611
857782  857782  857782  857782  857782  857782  857782      857782
746543  746543  746543  746543  746543  746543  746543  ...  746543
766789  766789  766789  766789  766789  766789  766789      766789
```

When the entire chain reaction comes to an end, 16 barrels have been destroyed.

How many barrels can the entire chain reaction destroy?

Your notes for this part:

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Part 1 solved with answer: 223

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Part II

Everything worked just as you had predicted. What's more, the remaining barrels were so heated by the explosions that after a few moments they ignited on their own, allowing you to destroy the entire first stockpile! Your strategy works!

The next clearing is slightly larger (your notes), but the rules remain the same as before. To reach the last stockpile of barrels, you must fly directly over the second one, along the diagonal, so you decide to try firing two fireballs.

The first target is the barrel in the top-left corner, just like before. The second target is the opposite barrel, in the bottom-right corner. For a better burning effect on the other barrels, you decide to fire both fireballs in such a way that both barrels are ignited at exactly the same moment.

Example based on the following notes:

```
9589233445
9679121695
8469121876
8352919876
7342914327
7234193437
6789193538
6781219648
5691219769
5443329859
```

The barrels ignited simultaneously in the corners trigger the following chain of destruction:

```
9589233445  9589233445  9589233445  9589233445      9589233445
9679121695  9679121695  9679121695  9679121695      9679121695
8469121876  8469121876  8469121876  8469121876      8469121876
8352919876  8352919876  8352919876  8352919876      8352919876
7342914327  7342914327  7342914327  7342914327      7342914327
7234193437  7234193437  7234193437  7234193437  ...  7234193437
6789193538  6789193538  6789193538  6789193538      6789193538
6781219648  6781219648  6781219648  6781219648      6781219648
5691219769  5691219769  5691219769  5691219769      5691219769
5443329859  5443329859  5443329859  5443329859      5443329859
```

When the entire chain reaction comes to an end, 58 barrels have been destroyed.

How many barrels can the entire chain reaction destroy?

Your notes for this part:

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Part 2 solved with answer: 5697

Check your progress

Part III

The final barrel stockpile is the largest of them all, so it would be wise to repeat the manoeuvre with several simultaneous fireballs, however, the grid is very large (your notes), and you see a dark figure leaving the castle at the head of a group of knights on horseback. Each one carries a powerful crossbow on their back, so you can't afford to spend too much time on the entire operation.

You decide to try to ignite the barrels with three simultaneous fireballs this time. But finding the optimal triple feels impossible even for you in such a timely situation. You decide to go with a greedy approach instead:

- Find the barrel that allows you to destroy the most barrels with a single fireball.
- Find the second barrel that allows you to destroy the most barrels, after the first chain reaction is over.
- Find the third barrel that allows you to destroy the most barrels, after the second chain reaction is over.
- Set the three selected barrels on fire simultaneously, and get your feathers out of here!

Example based on the following notes:

```
5411
3362
5235
3112
```

The best single strike is setting the barrel with the number `6` on fire. It destroys other barrels as follows:

```
5411
3362
5235
3112
```

For the second and the third barrel, you can choose any pair of barrels of size `5`. Overall, the whole chain reaction when three barrels are set on fire simultaneously destroys `14` barrels at most with your greedy approach.

The optimal solution would be setting three `5` barrels on fire simultaneously. With this strategy, only the barrel of size `6` would survive the chain reaction, but this would require much more time and effort to calculate.

```
41951111131882511179
32112222211508122215
31223333322105122219
31234444432147511128
91223333322176021892
60112222211166431583
04661111166111111746
01111119042122222177
41222108881233333219
71222127839122222196
56111026279711111507
```

For the second example, the chain of destruction may look as follows:

```
41951111131882511179    41951111131882511179          41951111131882511179
32112222211518122215    32112222211518122215          32112222211518122215
31223333322115122219    31223333322115122219          31223333322115122219
31234444432147511128    31234444432147511128          31234444432147511128
91223333322176121892    91223333322176121892          91223333322176121892
61112222211166431583    61112222211166431583    ...   61112222211166431583
14661111166111111746    14661111166111111746          14661111166111111746
11111119142122222177    11111119142122222177          11111119142122222177
41222118881233333219    41222118881233333219          41222118881233333219
71222127839122222196    71222127839122222196          71222127839122222196
56111126279711111517    56111126279711111517          56111126279711111517
```

When the entire chain reaction comes to an end, `133` barrels are destroyed, and this is the maximum number of barrels with three parallel fireballs in this case, when using the greedy approach.

How many barrels at most can be ultimately destroyed by setting the three barrels chosen with the greedy approach on fire simultaneously?

Your notes for this part:

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Part 3 solved with answer: 3996

Check your progress

Puzzle solved! Don't stop now!

Post your solution, compare ideas, and help others grow on Reddit