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--- Day 9: Sensor Boost ---

You've just said goodbye to the rebooted rover and left Mars when you
receive a faint distress signal coming from the asteroid belt. It must be
the Ceres monitoring station!

In order to lock on to the signal, you'll need to boost your sensors. The
Elves send up the latest BOOST program - Basic Operation Of System Test.

While BOOST (your puzzle input) is capable of boosting your sensors, for
tenuous safety reasons, it refuses to do so until the computer it runs on
passes some checks to demonstrate it is a complete Intcode computer.

Your existing Intcode computer is missing one key feature: it needs support
for parameters in relative mode.

Parameters in mode 2, relative mode, behave very similarly to parameters in
position mode: the parameter is interpreted as a position. Like position
mode, parameters in relative mode can be read from or written to.

The important difference is that relative mode parameters don't count from
address 0. Instead, they count from a value called the relative base. The
relative base starts at 0.

The address a relative mode parameter refers to is itself plus the current
relative base. When the relative base is 0, relative mode parameters and
position mode parameters with the same value refer to the same address.

For example, given a relative base of 50, a relative mode parameter of -7
refers to memory address 50 + -7 = 43.

The relative base is modified with the relative base offset instruction:

  - Opcode 9 adjusts the relative base by the value of its only parameter.
    The relative base increases (or decreases, if the value is negative)
    by the value of the parameter.

For example, if the relative base is 2000, then after the instruction
109,19, the relative base would be 2019. If the next instruction were
204,-34, then the value at address 1985 would be output.

Your Intcode computer will also need a few other capabilities:

  - The computer's available memory should be much larger than the initial
    program. Memory beyond the initial program starts with the value 0 and
    can be read or written like any other memory. (It is invalid to try to
    access memory at a negative address, though.)
  - The computer should have support for large numbers. Some instructions
    near the beginning of the BOOST program will verify this capability.

Here are some example programs that use these features:

  - 109,1,204,-1,1001,100,1,100,1008,100,16,101,1006,101,0,99 takes no
    input and produces a copy of itself as output.
  - 1102,34915192,34915192,7,4,7,99,0 should output a 16-digit number.
  - 104,1125899906842624,99 should output the large number in the middle.

The BOOST program will ask for a single input; run it in test mode by
providing it the value 1. It will perform a series of checks on each
opcode, output any opcodes (and the associated parameter modes) that seem
to be functioning incorrectly, and finally output a BOOST keycode.

Once your Intcode computer is fully functional, the BOOST program should
report no malfunctioning opcodes when run in test mode; it should only
output a single value, the BOOST keycode. What BOOST keycode does it
produce?

Your puzzle answer was 2682107844.

--- Part Two ---

You now have a complete Intcode computer.

Finally, you can lock on to the Ceres distress signal! You just need to boost your sensors using the BOOST program.

The program runs in sensor boost mode by providing the input instruction the value 2. Once run, it will boost the sensors automatically, but it might take a few seconds to complete the operation on slower hardware. In sensor boost mode, the program will output a single value: the coordinates of the distress signal.

Run the BOOST program in sensor boost mode. What are the coordinates of the distress signal?

Your puzzle answer was 34738.

Both parts of this puzzle are complete! They provide two gold stars: **

At this point, you should return to your Advent calendar and try another puzzle.

If you still want to see it, you can get your puzzle input.

You can also [Share] this puzzle.