

# ECS 36A: Programming Assignment #7

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Fall 2020

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## 1 Changelog

You should always refer to the latest version of this document.

- v.1: Initial version.

## 2 General Submission Details

**Partnering on this assignment is prohibited. If you have not already, you should read the section on academic misconduct in the syllabus.**

This assignment is due the night of Monday, December 14. Gradescope will say 12:30 AM on Tuesday, December 15, due to the “grace period” (as described in the syllabus). *Be careful about relying on the grace period for extra time; this could be risky.*

You should use the `-Wall` and `-Werror` flags when compiling. The autograder will use these flags when it compiles your program.

## 3 Grading Breakdown

TBA

## 4 Submitting on Gradescope

You should only submit `game.c`. You may be penalized for submitting additional files. You have infinite submissions until the deadline.

During the 10/02 lecture, I talked about how to change the active submission, just in case that is something that you find yourself wanting to do.

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## 4.1 Regarding Autograder

Your output must match mine *exactly*.

There is a description about how to interpret some of the autograder error messages in the directions for the previous two programming assignments. I will not repeat that description here.

### 4.1.1 Visible Test Cases' Inputs

TBA

## 5 Game

For this assignment, all that you have to do (in `game.c`) is implement one function: the function `playGame()` that is declared in `game.h`. **You will only submit `game.c`, so any changes that you make to `game.h` will be ignored.** The function `playGame()` should load data from the file whose name is passed to it and then allow the user to play a game. In this game, the player is represented by a single character on a board. In the below, the asterisks form the border of the board, the `A` is the player's icon, each `x` represents an enemy, the `*` (in the middle of the board) represents a "power orb", and each `$` represents an item. There are also two buildings on the board.

```
1 *****
2 *           X           *
3 * A           X       *
4 *           *           *
5 *           *-----*
6 *           -----*
7 *           --&&--*
8 * ----- --&&--*
9 * -----*
10 * --&&--*
11 *$--&&-- $*
12 *****
```

`playGame()` reads the contents of the board from a file. Below is the file that corresponds to the above board. **You may assume that the input file is properly formatted**; input validation is not a part of this assignment.

```
1 10 20
2 q r e w s
3 A B 1 1
4 B 3 11
5 B 6 1
6 E 0 11
7 E 1 16
8 I 9 0
9 I 9 19
10 P 3 10
```

**First two lines:** The first line contains the dimensions (height and width, respectively) of the board, not counting the borders (i.e. the asterisks). The second line contains the five keys that the user will use to move left, move right, move upwards, move downwards, and quit (respectively). It is possible that this line of the file is *empty*, in which case a set of default keys (left: 'a', right: 'd', up: 'w', down: 's', quit: 'q') should be used. Either all five keys will be provided, or none will be provided.

**Player line:** The third line starts with the *default icon* used to represent the player. In the above file, this is 'A', which is why A was the player's icon in the above map. The 'B' is the *powered icon*, which I talk more about below. Then, there are the starting coordinates (y-coordinate and x-coordinate, each zero-based) of the player. Note that a y-coordinate of 0 corresponds to the top row of the board, *not* the bottom row. Also note that the player's icon *could* be the same as the item's icon.

**Building, enemy, item, and power orb lines:** The game file will always have *at least one item* (you may assume this), but it may have zero buildings, zero enemies, and/or zero power orbs. At this point in the file, you will have the lines for the buildings (if any, and each starting with a 'B'), followed by the lines for the enemies (if any, and each starting with an 'E'), followed by the lines for the items (each starting with an 'I'), followed by the lines for the power orbs (if any, and each starting with a 'P'). For each of these kinds of lines, the special character is followed by the coordinates. Like the player, each of an enemy, an item, and a power orb take up one spot. A building always looks the same as you see it in the example above. That is, a building is always a 4-by-6 block of dashes, except for a "door" built with ampersands in the middle of it. In the case of a building, the provided coordinates locate its top-left. *You may assume that there are no overlapping elements, e.g. there won't be an item inside of a building. You may assume that everything is in bounds, e.g. there won't be a building that is halfway outside the boundaries of the board.*

**End conditions:** The game ends when any of the below conditions occur. Depending on which end condition is achieved, your program should print a specific message; see the examples below. The player is always shown their ending score. Moreover, if the player loses by dying, then the board is shown one extra time; one of the examples emphasizes this.

- The player quits using the quit key.
- The player wins by collecting all of the items.
- The player dies.

**Input and collision detection:** When prompting the user for input, if they do not enter one of the four movement keys or the quit key, then they should be prompted again (see the examples below). Each movement key *attempts* to move the player one unit in the indicated direction. Certain events occur based on what the player interacts/collides with:

- **Borders:** The player is prevented from going through the board's borders.
- **Building:** The player is prevented from going through the building.
- **Item:** The player collects the item, removing it from the game.
- **Power orb<sup>1</sup>:** When the player touches a power orb, they enter “power mode”. While they are in power mode, their icon is the powered icon that was mentioned above, instead of the default icon. They remain in power mode during their next 7 inputs. This duration is reset/replenished (back to 7) if they touch another power orb during this time. Note that during the last input in which the player is in power mode, their power mode should run out *immediately after* they enter their input / before collision detection is done; see one of the examples below, where I specifically comment about this. Also note that the duration goes down even if the player's input is wasted, e.g. if they spent the next 7 inputs trying to move into a wall (and thus move nowhere), then the power mode will expire.
- **Enemy:**
  - *If NOT in power mode* (default): The player dies, and the game ends. As stated in the end conditions above, the board should be printed one more time in this case, and the player's icon will be a ☺ (that's the character that I felt most looked like an explosion).
  - *If in power mode:* The player removes the enemy from the game.

**Indicators:** As you can see in the examples, I'm always shown the current score and the number of items remaining. The score is incremented whenever an item is collected or (while in power mode) an enemy is destroyed/eaten<sup>2</sup>/collected.

**Here are some suggestions that you may or may not find helpful:**

- After performing some setup, your game could go to what we will call its “main loop”, which is the loop that keeps the game going until an end condition is satisfied. In each iteration of this loop, the game should be drawn, and then user input should be obtained, and then *updates* (movement, collision detection, etc., where applicable) should be performed.
- I would start small and make sure things still work as you make gradual, carefully thought out changes. An example of this would be to start with a file that only contains the bare minimum requirements, i.e. the first three lines and then a single item, all on a small board. Don't try to type a lot of code at once without pausing to check if any of it works.
- I used a *lot* of helper functions to organize my code when I thought it would help me think about the different steps. Here are examples of helper functions that I had: `setupBoard()`, `loadKeys()`, `drawBuilding()`, `getInput()`. Each helper function identifies a clear step, and this helped me to write my solution in a methodical manner.
- I lost a bit of time dealing with that the second line could be blank because I was using a mix of `fgets()` and `fscanf()` to read the file. If you put a newline character at the end of the format string of `fscanf()` and there are two newline characters in a row (which occurs when the second line is blank), `fscanf()` will read *both* (not just one) of those newline characters (after reading whatever else it was supposed to read according to the format string).

**Memory leaks:** Your program should have none, and you should close any files that are opened.

**Below is a list of headers that you *are* allowed to include in `game.c`.** You may not need all of these.

- `game.h`
- `<stdio.h>`
- `<stdlib.h>`
- `<stdbool.h>`
- `<ctype.h>`
- `<string.h>`
- `<limits.h>`
- `<assert.h>`

---

<sup>1</sup>Power orbs mimic the behavior of “power pellets” in the game Pac-Man.

<sup>2</sup>If you prefer the Pac-Man-like term.

Below are examples of how your code should behave. You can find all of the demo files (e.g. `main.c`, `game2.txt`) on Canvas.

```

1 $ cat main.c
2 #include "game.h"
3
4 int main(int argc, char *argv[])
5 {
6     playGame(argc >= 2 ? argv[1] : "game1.txt");
7 }
8 $ cat game1.txt
9 10 20
10
11 A B 1 1
12 B 3 11
13 B 6 1
14 E 0 11
15 E 1 16
16 I 9 0
17 I 9 19
18 P 3 10
19 $ gcc -Wall -Werror main.c game.c -o main
20 $ ./main # Example in which I quit.
21 Score: 0
22 Items remaining: 2
23 *****
24 *           X           *
25 * A           X       *
26 *           *         *
27 *           *-----*
28 *           -----*
29 *           --&&--*
30 * ----- --&&--*
31 * -----*
32 * --&&--*
33 *$--&&-- $*
34 *****
35 Enter input: q
36 You have quit.
37 Final score: 0
38 $ ./main # Example in which I'm killed by an enemy.
39 Score: 0
40 Items remaining: 2
41 *****
42 *           X           *
43 * A           X       *
44 *           *         *
45 *           *-----*
46 *           -----*
47 *           --&&--*
48 * ----- --&&--*
49 * -----*
50 * --&&--*
51 *$--&&-- $*
52 *****
53 Enter input: d
54 Score: 0
55 Items remaining: 2
56 *****
57 *           X           *
58 * A           X       *
59 *           *         *
60 *           *-----*
61 *           -----*
62 *           --&&--*
63 * ----- --&&--*
64 * -----*
65 * --&&--*
66 *$--&&-- $*
67 *****
68 Enter input: d
69 Score: 0
70 Items remaining: 2
71 *****
72 *           X           *

```

```

73 *      A          X      *
74 *                                *
75 *      *-----      *
76 *      -----      *
77 *      --&&--      *
78 *  -----      --&&--      *
79 *  -----      *
80 *  --&&--      *
81 *$--&&--      $*
82 *****
83 Enter input: w
84 Score: 0
85 Items remaining: 2
86 *****
87 *      A          X      *
88 *                                X      *
89 *                                *
90 *      *-----      *
91 *      -----      *
92 *      --&&--      *
93 *  -----      --&&--      *
94 *  -----      *
95 *  --&&--      *
96 *$--&&--      $*
97 *****
98 Enter input: d
99 Score: 0
100 Items remaining: 2
101 *****
102 *      A          X      *
103 *                                X      *
104 *                                *
105 *      *-----      *
106 *      -----      *
107 *      --&&--      *
108 *  -----      --&&--      *
109 *  -----      *
110 *  --&&--      *
111 *$--&&--      $*
112 *****
113 Enter input: d
114 Score: 0
115 Items remaining: 2
116 *****
117 *      A          X      *
118 *                                X      *
119 *                                *
120 *      *-----      *
121 *      -----      *
122 *      --&&--      *
123 *  -----      --&&--      *
124 *  -----      *
125 *  --&&--      *
126 *$--&&--      $*
127 *****
128 Enter input: d
129 Score: 0
130 Items remaining: 2
131 *****
132 *      A          X      *
133 *                                X      *
134 *                                *
135 *      *-----      *
136 *      -----      *
137 *      --&&--      *
138 *  -----      --&&--      *
139 *  -----      *
140 *  --&&--      *
141 *$--&&--      $*
142 *****
143 Enter input: d
144 Score: 0
145 Items remaining: 2
146 *****

```

```

147 *      A      X      *
148 *              X      *
149 *              *      *
150 *      *-----*      *
151 *      -----*      *
152 *      --&&--*      *
153 *  -----  --&&--*      *
154 *  -----*      *
155 *  --&&--*      *
156 *$--&&--*      $*
157 *****
158 Enter input: d
159 Score: 0
160 Items remaining: 2
161 *****
162 *      A      X      *
163 *              X      *
164 *              *      *
165 *      *-----*      *
166 *      -----*      *
167 *      --&&--*      *
168 *  -----  --&&--*      *
169 *  -----*      *
170 *  --&&--*      *
171 *$--&&--*      $*
172 *****
173 Enter input: d
174 Score: 0
175 Items remaining: 2
176 *****
177 *      A      X      *
178 *              X      *
179 *              *      *
180 *      *-----*      *
181 *      -----*      *
182 *      --&&--*      *
183 *  -----  --&&--*      *
184 *  -----*      *
185 *  --&&--*      *
186 *$--&&--*      $*
187 *****
188 Enter input: d
189 Score: 0
190 Items remaining: 2
191 *****
192 *      AX      *
193 *              X      *
194 *              *      *
195 *      *-----*      *
196 *      -----*      *
197 *      --&&--*      *
198 *  -----  --&&--*      *
199 *  -----*      *
200 *  --&&--*      *
201 *$--&&--*      $*
202 *****
203 Enter input: d
204 Score: 0
205 Items remaining: 2
206 *****
207 *      @      *
208 *              X      *
209 *              *      *
210 *      *-----*      *
211 *      -----*      *
212 *      --&&--*      *
213 *  -----  --&&--*      *
214 *  -----*      *
215 *  --&&--*      *
216 *$--&&--*      $*
217 *****
218 You have died.
219 Final score: 0
220 $ ./main # Example in which I win by collecting all items.

```

```

221 Score: 0
222 Items remaining: 2
223 *****
224 *           X           *
225 *   A               X   *
226 *                   *   *
227 *           *----- *
228 *           ----- *
229 *           --&&-- *
230 * ----- --&&-- *
231 * ----- *
232 * --&&-- *
233 *$--&&-- $*
234 *****
235 Enter input: a
236 Score: 0
237 Items remaining: 2
238 *****
239 *           X           *
240 *A               X   *
241 *                   *   *
242 *           *----- *
243 *           ----- *
244 *           --&&-- *
245 * ----- --&&-- *
246 * ----- *
247 * --&&-- *
248 *$--&&-- $*
249 *****
250 Enter input: s
251 Score: 0
252 Items remaining: 2
253 *****
254 *           X           *
255 *               X       *
256 *A                   *   *
257 *           *----- *
258 *           ----- *
259 *           --&&-- *
260 * ----- --&&-- *
261 * ----- *
262 * --&&-- *
263 *$--&&-- $*
264 *****
265 Enter input: s
266 Score: 0
267 Items remaining: 2
268 *****
269 *           X           *
270 *               X       *
271 *                   *   *
272 *A           *----- *
273 *           ----- *
274 *           --&&-- *
275 * ----- --&&-- *
276 * ----- *
277 * --&&-- *
278 *$--&&-- $*
279 *****
280 Enter input: s
281 Score: 0
282 Items remaining: 2
283 *****
284 *           X           *
285 *               X       *
286 *                   *   *
287 *           *----- *
288 *A           ----- *
289 *           --&&-- *
290 * ----- --&&-- *
291 * ----- *
292 * --&&-- *
293 *$--&&-- $*
294 *****

```

```

295 Enter input: s
296 Score: 0
297 Items remaining: 2
298 *****
299 *           X           *
300 *               X       *
301 *                   *     *
302 *               *-----*
303 *               -----*
304 *A             --&&--    *
305 * -----      --&&--    *
306 * -----                      *
307 * --&&--                      *
308 *$--&&--                      $*
309 *****
310 Enter input: s
311 Score: 0
312 Items remaining: 2
313 *****
314 *           X           *
315 *               X       *
316 *                   *     *
317 *               *-----*
318 *               -----*
319 *             --&&--    *
320 *A-----      --&&--    *
321 * -----                      *
322 * --&&--                      *
323 *$--&&--                      $*
324 *****
325 Enter input: s
326 Score: 0
327 Items remaining: 2
328 *****
329 *           X           *
330 *               X       *
331 *                   *     *
332 *               *-----*
333 *               -----*
334 *             --&&--    *
335 * -----      --&&--    *
336 *A-----                      *
337 * --&&--                      *
338 *$--&&--                      $*
339 *****
340 Enter input: s
341 Score: 0
342 Items remaining: 2
343 *****
344 *           X           *
345 *               X       *
346 *                   *     *
347 *               *-----*
348 *               -----*
349 *             --&&--    *
350 * -----      --&&--    *
351 * -----                      *
352 *A--&&--                      *
353 *$--&&--                      $*
354 *****
355 Enter input: s
356 Score: 1
357 Items remaining: 1
358 *****
359 *           X           *
360 *               X       *
361 *                   *     *
362 *               *-----*
363 *               -----*
364 *             --&&--    *
365 * -----      --&&--    *
366 * -----                      *
367 * --&&--                      *
368 *A--&&--                      $*

```



```

369 *****
370 Enter input: w
371 Score: 1
372 Items remaining: 1
373 *****
374 *           X           *
375 *                   X   *
376 *                   *   *
377 *           *-----*   *
378 *           -----*   *
379 *           --&&--*   *
380 * ----- --&&--*   *
381 * -----*   *
382 *A--&&--*   *
383 * --&&-- $*
384 *****
385 Enter input: w
386 Score: 1
387 Items remaining: 1
388 *****
389 *           X           *
390 *                   X   *
391 *                   *   *
392 *           *-----*   *
393 *           -----*   *
394 *           --&&--*   *
395 * ----- --&&--*   *
396 *A-----*   *
397 * --&&--*   *
398 * --&&-- $*
399 *****
400 Enter input: w
401 Score: 1
402 Items remaining: 1
403 *****
404 *           X           *
405 *                   X   *
406 *                   *   *
407 *           *-----*   *
408 *           -----*   *
409 *           --&&--*   *
410 *A----- --&&--*   *
411 * -----*   *
412 * --&&--*   *
413 * --&&-- $*
414 *****
415 Enter input: w
416 Score: 1
417 Items remaining: 1
418 *****
419 *           X           *
420 *                   X   *
421 *                   *   *
422 *           *-----*   *
423 *           -----*   *
424 *A           --&&--*   *
425 * ----- --&&--*   *
426 * -----*   *
427 * --&&--*   *
428 * --&&-- $*
429 *****
430 Enter input: d
431 Score: 1
432 Items remaining: 1
433 *****
434 *           X           *
435 *                   X   *
436 *                   *   *
437 *           *-----*   *
438 *           -----*   *
439 * A           --&&--*   *
440 * ----- --&&--*   *
441 * -----*   *
442 * --&&--*   *

```

```

443 * --&&-- $*
444 *****
445 Enter input: d
446 Score: 1
447 Items remaining: 1
448 *****
449 *           X           *
450 *                   X   *
451 *                   *   *
452 *           *----- *
453 *           ----- *
454 *   A           --&&-- *
455 *   -----   --&&-- *
456 *   ----- *
457 *   --&&-- *
458 *   --&&-- $*
459 *****
460 Enter input: d
461 Score: 1
462 Items remaining: 1
463 *****
464 *           X           *
465 *                   X   *
466 *                   *   *
467 *           *----- *
468 *           ----- *
469 *   A           --&&-- *
470 *   -----   --&&-- *
471 *   ----- *
472 *   --&&-- *
473 *   --&&-- $*
474 *****
475 Enter input: d
476 Score: 1
477 Items remaining: 1
478 *****
479 *           X           *
480 *                   X   *
481 *                   *   *
482 *           *----- *
483 *           ----- *
484 *   A           --&&-- *
485 *   -----   --&&-- *
486 *   ----- *
487 *   --&&-- *
488 *   --&&-- $*
489 *****
490 Enter input: d
491 Score: 1
492 Items remaining: 1
493 *****
494 *           X           *
495 *                   X   *
496 *                   *   *
497 *           *----- *
498 *           ----- *
499 *   A           --&&-- *
500 *   -----   --&&-- *
501 *   ----- *
502 *   --&&-- *
503 *   --&&-- $*
504 *****
505 Enter input: d
506 Score: 1
507 Items remaining: 1
508 *****
509 *           X           *
510 *                   X   *
511 *                   *   *
512 *           *----- *
513 *           ----- *
514 *   A           --&&-- *
515 *   -----   --&&-- *
516 *   ----- *

```

```

517 * --&&-- *
518 * --&&-- $*
519 *****
520 Enter input: d
521 Score: 1
522 Items remaining: 1
523 *****
524 *          X          *
525 *                X    *
526 *                *     *
527 *          *----- *
528 *          ----- *
529 *      A    --&&-- *
530 * ----- --&&-- *
531 * ----- *
532 * --&&-- *
533 * --&&-- $*
534 *****
535 Enter input: s
536 Score: 1
537 Items remaining: 1
538 *****
539 *          X          *
540 *                X    *
541 *                *     *
542 *          *----- *
543 *          ----- *
544 *          --&&-- *
545 * -----A --&&-- *
546 * ----- *
547 * --&&-- *
548 * --&&-- $*
549 *****
550 Enter input: s
551 Score: 1
552 Items remaining: 1
553 *****
554 *          X          *
555 *                X    *
556 *                *     *
557 *          *----- *
558 *          ----- *
559 *          --&&-- *
560 * ----- --&&-- *
561 * -----A *
562 * --&&-- *
563 * --&&-- $*
564 *****
565 Enter input: s
566 Score: 1
567 Items remaining: 1
568 *****
569 *          X          *
570 *                X    *
571 *                *     *
572 *          *----- *
573 *          ----- *
574 *          --&&-- *
575 * ----- --&&-- *
576 * ----- *
577 * --&&--A *
578 * --&&-- $*
579 *****
580 Enter input: s
581 Score: 1
582 Items remaining: 1
583 *****
584 *          X          *
585 *                X    *
586 *                *     *
587 *          *----- *
588 *          ----- *
589 *          --&&-- *
590 * ----- --&&-- *

```

```

591 * ----- *
592 * --&&-- *
593 * --&&--A $*
594 *****
595 Enter input: d
596 Score: 1
597 Items remaining: 1
598 *****
599 * X *
600 * X *
601 * *
602 * *----- *
603 * ----- *
604 * --&&-- *
605 * ----- --&&-- *
606 * ----- *
607 * --&&-- *
608 * --&&-- A $*
609 *****
610 Enter input: d
611 Score: 1
612 Items remaining: 1
613 *****
614 * X *
615 * X *
616 * *
617 * *----- *
618 * ----- *
619 * --&&-- *
620 * ----- --&&-- *
621 * ----- *
622 * --&&-- *
623 * --&&-- A $*
624 *****
625 Enter input: d
626 Score: 1
627 Items remaining: 1
628 *****
629 * X *
630 * X *
631 * *
632 * *----- *
633 * ----- *
634 * --&&-- *
635 * ----- --&&-- *
636 * ----- *
637 * --&&-- *
638 * --&&-- A $*
639 *****
640 Enter input: d
641 Score: 1
642 Items remaining: 1
643 *****
644 * X *
645 * X *
646 * *
647 * *----- *
648 * ----- *
649 * --&&-- *
650 * ----- --&&-- *
651 * ----- *
652 * --&&-- *
653 * --&&-- A $*
654 *****
655 Enter input: d
656 Score: 1
657 Items remaining: 1
658 *****
659 * X *
660 * X *
661 * *
662 * *----- *
663 * ----- *
664 * --&&-- *

```

```

665 * ----- --&&-- *
666 * ----- *
667 * --&&-- *
668 * --&&-- A $*
669 *****
670 Enter input: d
671 Score: 1
672 Items remaining: 1
673 *****
674 * X *
675 * X *
676 * *
677 * *----- *
678 * ----- *
679 * --&&-- *
680 * ----- --&&-- *
681 * ----- *
682 * --&&-- *
683 * --&&-- A $*
684 *****
685 Enter input: d
686 Score: 1
687 Items remaining: 1
688 *****
689 * X *
690 * X *
691 * *
692 * *----- *
693 * ----- *
694 * --&&-- *
695 * ----- --&&-- *
696 * ----- *
697 * --&&-- *
698 * --&&-- A $*
699 *****
700 Enter input: d
701 Score: 1
702 Items remaining: 1
703 *****
704 * X *
705 * X *
706 * *
707 * *----- *
708 * ----- *
709 * --&&-- *
710 * ----- --&&-- *
711 * ----- *
712 * --&&-- *
713 * --&&-- A $*
714 *****
715 Enter input: d
716 Score: 1
717 Items remaining: 1
718 *****
719 * X *
720 * X *
721 * *
722 * *----- *
723 * ----- *
724 * --&&-- *
725 * ----- --&&-- *
726 * ----- *
727 * --&&-- *
728 * --&&-- A $*
729 *****
730 Enter input: d
731 Score: 1
732 Items remaining: 1
733 *****
734 * X *
735 * X *
736 * *
737 * *----- *
738 * ----- *

```

```

739 *      --&&-- *
740 * ----- --&&-- *
741 * ----- *
742 * --&&-- *
743 * --&&-- A $*
744 *****
745 Enter input: d
746 Score: 1
747 Items remaining: 1
748 *****
749 *      X      *
750 *          X   *
751 *          *   *
752 *      *----- *
753 *      ----- *
754 *      --&&-- *
755 * ----- --&&-- *
756 * ----- *
757 * --&&-- *
758 * --&&-- A$*
759 *****
760 Enter input: d
761 Congratulations! You have won.
762 Final score: 2
763 $ ./main # Example in which I show what I can't walk through.
764 Score: 0
765 Items remaining: 2
766 *****
767 *      X      *
768 * A          X *
769 *          *   *
770 *      *----- *
771 *      ----- *
772 *      --&&-- *
773 * ----- --&&-- *
774 * ----- *
775 * --&&-- *
776 * $--&&-- $*
777 *****
778 Enter input: a
779 Score: 0
780 Items remaining: 2
781 *****
782 *      X      *
783 *A          X *
784 *          *   *
785 *      *----- *
786 *      ----- *
787 *      --&&-- *
788 * ----- --&&-- *
789 * ----- *
790 * --&&-- *
791 * $--&&-- $*
792 *****
793 Enter input: a
794 Score: 0
795 Items remaining: 2
796 *****
797 *      X      *
798 *A          X *
799 *          *   *
800 *      *----- *
801 *      ----- *
802 *      --&&-- *
803 * ----- --&&-- *
804 * ----- *
805 * --&&-- *
806 * $--&&-- $*
807 *****
808 Enter input: w
809 Score: 0
810 Items remaining: 2
811 *****
812 *A      X      *

```

```

813 *           X      *
814 *           *      *
815 *      *-----*
816 *      -----*
817 *      --&&--*
818 *  -----  --&&--*
819 *  -----*
820 *  --&&--*
821 *$--&&--$*
822 *****
823 Enter input: w
824 Score: 0
825 Items remaining: 2
826 *****
827 *A           X      *
828 *           X      *
829 *           *      *
830 *      *-----*
831 *      -----*
832 *      --&&--*
833 *  -----  --&&--*
834 *  -----*
835 *  --&&--*
836 *$--&&--$*
837 *****
838 Enter input: d
839 Score: 0
840 Items remaining: 2
841 *****
842 * A           X      *
843 *           X      *
844 *           *      *
845 *      *-----*
846 *      -----*
847 *      --&&--*
848 *  -----  --&&--*
849 *  -----*
850 *  --&&--*
851 *$--&&--$*
852 *****
853 Enter input: s
854 Score: 0
855 Items remaining: 2
856 *****
857 *           X      *
858 * A           X      *
859 *           *      *
860 *      *-----*
861 *      -----*
862 *      --&&--*
863 *  -----  --&&--*
864 *  -----*
865 *  --&&--*
866 *$--&&--$*
867 *****
868 Enter input: s
869 Score: 0
870 Items remaining: 2
871 *****
872 *           X      *
873 *           X      *
874 * A           *      *
875 *      *-----*
876 *      -----*
877 *      --&&--*
878 *  -----  --&&--*
879 *  -----*
880 *  --&&--*
881 *$--&&--$*
882 *****
883 Enter input: s
884 Score: 0
885 Items remaining: 2
886 *****

```

```

887 *           X           *
888 *               X       *
889 *                   *     *
890 *  A           *----- *
891 *               ----- *
892 *               --&&-- *
893 *  -----      --&&-- *
894 *  ----- *
895 *  --&&-- *
896 *$--&&-- $*
897 *****
898 Enter input: s
899 Score: 0
900 Items remaining: 2
901 *****
902 *           X           *
903 *               X       *
904 *                   *     *
905 *  A           *----- *
906 *               ----- *
907 *               --&&-- *
908 *  -----      --&&-- *
909 *  ----- *
910 *  --&&-- *
911 *$--&&-- $*
912 *****
913 Enter input: s
914 Score: 0
915 Items remaining: 2
916 *****
917 *           X           *
918 *               X       *
919 *                   *     *
920 *  A           *----- *
921 *               ----- *
922 *               --&&-- *
923 *  -----      --&&-- *
924 *  ----- *
925 *  --&&-- *
926 *$--&&-- $*
927 *****
928 Enter input: s
929 Score: 0
930 Items remaining: 2
931 *****
932 *           X           *
933 *               X       *
934 *                   *     *
935 *  A           *----- *
936 *               ----- *
937 *               --&&-- *
938 *  -----      --&&-- *
939 *  ----- *
940 *  --&&-- *
941 *$--&&-- $*
942 *****
943 Enter input: d
944 Score: 0
945 Items remaining: 2
946 *****
947 *           X           *
948 *               X       *
949 *                   *     *
950 *  A           *----- *
951 *               ----- *
952 *               --&&-- *
953 *  -----      --&&-- *
954 *  ----- *
955 *  --&&-- *
956 *$--&&-- $*
957 *****
958 Enter input: d
959 Score: 0
960 Items remaining: 2

```



```

961 *****
962 *           X           *
963 *                   X   *
964 *                   *   *
965 *           *-----*   *
966 *           -----*   *
967 *   A           --&&--*   *
968 *   -----   --&&--*   *
969 *   -----*   *
970 *   --&&--*   *
971 *$--&&--$*
972 *****
973 Enter input: d
974 Score: 0
975 Items remaining: 2
976 *****
977 *           X           *
978 *                   X   *
979 *                   *   *
980 *           *-----*   *
981 *           -----*   *
982 *   A           --&&--*   *
983 *   -----   --&&--*   *
984 *   -----*   *
985 *   --&&--*   *
986 *$--&&--$*
987 *****
988 Enter input: d
989 Score: 0
990 Items remaining: 2
991 *****
992 *           X           *
993 *                   X   *
994 *                   *   *
995 *           *-----*   *
996 *           -----*   *
997 *   A           --&&--*   *
998 *   -----   --&&--*   *
999 *   -----*   *
1000 *   --&&--*   *
1001 *$--&&--$*
1002 *****
1003 Enter input: d
1004 Score: 0
1005 Items remaining: 2
1006 *****
1007 *           X           *
1008 *                   X   *
1009 *                   *   *
1010 *           *-----*   *
1011 *           -----*   *
1012 *   A           --&&--*   *
1013 *   -----   --&&--*   *
1014 *   -----*   *
1015 *   --&&--*   *
1016 *$--&&--$*
1017 *****
1018 Enter input: d
1019 Score: 0
1020 Items remaining: 2
1021 *****
1022 *           X           *
1023 *                   X   *
1024 *                   *   *
1025 *           *-----*   *
1026 *           -----*   *
1027 *   A           --&&--*   *
1028 *   -----   --&&--*   *
1029 *   -----*   *
1030 *   --&&--*   *
1031 *$--&&--$*
1032 *****
1033 Enter input: d
1034 Score: 0

```

```

1035 Items remaining: 2
1036 *****
1037 *           X           *
1038 *                   X   *
1039 *                   *   *
1040 *           *----- *
1041 *           ----- *
1042 *           A  --&&-- *
1043 * -----  --&&-- *
1044 * ----- *
1045 * --&&-- *
1046 *$--&&-- $*
1047 *****
1048 Enter input: d
1049 Score: 0
1050 Items remaining: 2
1051 *****
1052 *           X           *
1053 *                   X   *
1054 *                   *   *
1055 *           *----- *
1056 *           ----- *
1057 *           A  --&&-- *
1058 * -----  --&&-- *
1059 * ----- *
1060 * --&&-- *
1061 *$--&&-- $*
1062 *****
1063 Enter input: d
1064 Score: 0
1065 Items remaining: 2
1066 *****
1067 *           X           *
1068 *                   X   *
1069 *                   *   *
1070 *           *----- *
1071 *           ----- *
1072 *           A  --&&-- *
1073 * -----  --&&-- *
1074 * ----- *
1075 * --&&-- *
1076 *$--&&-- $*
1077 *****
1078 Enter input: d
1079 Score: 0
1080 Items remaining: 2
1081 *****
1082 *           X           *
1083 *                   X   *
1084 *                   *   *
1085 *           *----- *
1086 *           ----- *
1087 *           A  --&&-- *
1088 * -----  --&&-- *
1089 * ----- *
1090 * --&&-- *
1091 *$--&&-- $*
1092 *****
1093 Enter input: s
1094 Score: 0
1095 Items remaining: 2
1096 *****
1097 *           X           *
1098 *                   X   *
1099 *                   *   *
1100 *           *----- *
1101 *           ----- *
1102 *           --&&-- *
1103 * -----  A--&&-- *
1104 * ----- *
1105 * --&&-- *
1106 *$--&&-- $*
1107 *****
1108 Enter input: d

```

```

1109 Score: 0
1110 Items remaining: 2
1111 *****
1112 *           X           *
1113 *                   X   *
1114 *                   *    *
1115 *           *----- *
1116 *           ----- *
1117 *           --&&-- *
1118 * ----- A--&&-- *
1119 * ----- *
1120 * --&&-- *
1121 *$--&&-- $*
1122 *****
1123 Enter input: s
1124 Score: 0
1125 Items remaining: 2
1126 *****
1127 *           X           *
1128 *                   X   *
1129 *                   *    *
1130 *           *----- *
1131 *           ----- *
1132 *           --&&-- *
1133 * ----- --&&-- *
1134 * ----- A *
1135 * --&&-- *
1136 *$--&&-- $*
1137 *****
1138 Enter input: d
1139 Score: 0
1140 Items remaining: 2
1141 *****
1142 *           X           *
1143 *                   X   *
1144 *                   *    *
1145 *           *----- *
1146 *           ----- *
1147 *           --&&-- *
1148 * ----- --&&-- *
1149 * ----- A *
1150 * --&&-- *
1151 *$--&&-- $*
1152 *****
1153 Enter input: w
1154 Score: 0
1155 Items remaining: 2
1156 *****
1157 *           X           *
1158 *                   X   *
1159 *                   *    *
1160 *           *----- *
1161 *           ----- *
1162 *           --&&-- *
1163 * ----- --&&-- *
1164 * ----- A *
1165 * --&&-- *
1166 *$--&&-- $*
1167 *****
1168 Enter input: d
1169 Score: 0
1170 Items remaining: 2
1171 *****
1172 *           X           *
1173 *                   X   *
1174 *                   *    *
1175 *           *----- *
1176 *           ----- *
1177 *           --&&-- *
1178 * ----- --&&-- *
1179 * ----- A *
1180 * --&&-- *
1181 *$--&&-- $*
1182 *****

```

```

1183 Enter input: d
1184 Score: 0
1185 Items remaining: 2
1186 *****
1187 *           X           *
1188 *                   X   *
1189 *                   *   *
1190 *           *-----*   *
1191 *           -----*   *
1192 *           --&&--*   *
1193 * ----- --&&--*   *
1194 * -----      A   *
1195 * --&&--*   *
1196 *$--&&--*   $*
1197 *****
1198 Enter input: w
1199 Score: 0
1200 Items remaining: 2
1201 *****
1202 *           X           *
1203 *                   X   *
1204 *                   *   *
1205 *           *-----*   *
1206 *           -----*   *
1207 *           --&&--*   *
1208 * ----- --&&--*   *
1209 * -----      A   *
1210 * --&&--*   *
1211 *$--&&--*   $*
1212 *****
1213 Enter input: d
1214 Score: 0
1215 Items remaining: 2
1216 *****
1217 *           X           *
1218 *                   X   *
1219 *                   *   *
1220 *           *-----*   *
1221 *           -----*   *
1222 *           --&&--*   *
1223 * ----- --&&--*   *
1224 * -----      A   *
1225 * --&&--*   *
1226 *$--&&--*   $*
1227 *****
1228 Enter input: d
1229 Score: 0
1230 Items remaining: 2
1231 *****
1232 *           X           *
1233 *                   X   *
1234 *                   *   *
1235 *           *-----*   *
1236 *           -----*   *
1237 *           --&&--*   *
1238 * ----- --&&--*   *
1239 * -----      A   *
1240 * --&&--*   *
1241 *$--&&--*   $*
1242 *****
1243 Enter input: d
1244 Score: 0
1245 Items remaining: 2
1246 *****
1247 *           X           *
1248 *                   X   *
1249 *                   *   *
1250 *           *-----*   *
1251 *           -----*   *
1252 *           --&&--*   *
1253 * ----- --&&--*   *
1254 * -----      A   *
1255 * --&&--*   *
1256 *$--&&--*   $*

```

```

1257 *****
1258 Enter input: d
1259 Score: 0
1260 Items remaining: 2
1261 *****
1262 *           X           *
1263 *                   X   *
1264 *                   *   *
1265 *           *-----*   *
1266 *           -----*   *
1267 *           --&&--*   *
1268 * ----- --&&--*   *
1269 * ----- A *   *
1270 * --&&--*   *
1271 *$--&&-- $*   *
1272 *****
1273 Enter input: d
1274 Score: 0
1275 Items remaining: 2
1276 *****
1277 *           X           *
1278 *                   X   *
1279 *                   *   *
1280 *           *-----*   *
1281 *           -----*   *
1282 *           --&&--*   *
1283 * ----- --&&--*   *
1284 * ----- A *   *
1285 * --&&--*   *
1286 *$--&&-- $*   *
1287 *****
1288 Enter input: d
1289 Score: 0
1290 Items remaining: 2
1291 *****
1292 *           X           *
1293 *                   X   *
1294 *                   *   *
1295 *           *-----*   *
1296 *           -----*   *
1297 *           --&&--*   *
1298 * ----- --&&--*   *
1299 * ----- A*   *
1300 * --&&--*   *
1301 *$--&&-- $*   *
1302 *****
1303 Enter input: d
1304 Score: 0
1305 Items remaining: 2
1306 *****
1307 *           X           *
1308 *                   X   *
1309 *                   *   *
1310 *           *-----*   *
1311 *           -----*   *
1312 *           --&&--*   *
1313 * ----- --&&--*   *
1314 * ----- A*   *
1315 * --&&--*   *
1316 *$--&&-- $*   *
1317 *****
1318 Enter input: s
1319 Score: 0
1320 Items remaining: 2
1321 *****
1322 *           X           *
1323 *                   X   *
1324 *                   *   *
1325 *           *-----*   *
1326 *           -----*   *
1327 *           --&&--*   *
1328 * ----- --&&--*   *
1329 * -----*   *
1330 * --&&-- A*

```

```

1331 *$--&&--          $*
1332 *****
1333 Enter input: s
1334 Score: 1
1335 Items remaining: 1
1336 *****
1337 *           X       *
1338 *           X       *
1339 *           *
1340 *           *-----*
1341 *           -----*
1342 *           --&&--*
1343 *  -----  --&&--*
1344 *  -----  *
1345 *  --&&--    *
1346 *$--&&--          A*
1347 *****
1348 Enter input: s
1349 Score: 1
1350 Items remaining: 1
1351 *****
1352 *           X       *
1353 *           X       *
1354 *           *
1355 *           *-----*
1356 *           -----*
1357 *           --&&--*
1358 *  -----  --&&--*
1359 *  -----  *
1360 *  --&&--    *
1361 *$--&&--          A*
1362 *****
1363 Enter input: q
1364 You have quit.
1365 Final score: 1
1366 $ ./main          # Example in which I enter invalid input.
1367 Score: 0
1368 Items remaining: 2
1369 *****
1370 *           X       *
1371 * A           X       *
1372 *           *
1373 *           *-----*
1374 *           -----*
1375 *           --&&--*
1376 *  -----  --&&--*
1377 *  -----  *
1378 *  --&&--    *
1379 *$--&&--          $*
1380 *****
1381 Enter input: g
1382 Invalid input.
1383 Enter input: z
1384 Invalid input.
1385 Enter input: a
1386 Score: 0
1387 Items remaining: 2
1388 *****
1389 *           X       *
1390 *A           X       *
1391 *           *
1392 *           *-----*
1393 *           -----*
1394 *           --&&--*
1395 *  -----  --&&--*
1396 *  -----  *
1397 *  --&&--    *
1398 *$--&&--          $*
1399 *****
1400 Enter input: q
1401 You have quit.
1402 Final score: 0
1403 $ cat game2.txt    # Example in which different movement/quit keys are used.
1404 6 8

```

```

1405 q r e w s
1406 < C 0 7
1407 B 1 1
1408 E 3 0
1409 E 5 6
1410 I 2 0
1411 P 5 7
1412 P 5 4
1413 $ ./main game2.txt
1414 Score: 0
1415 Items remaining: 1
1416 *****
1417 *          < *
1418 * ----- *
1419 * $----- *
1420 * X--&&-- *
1421 * --&&-- *
1422 *      * X**
1423 *****
1424 Enter input: q
1425 Score: 0
1426 Items remaining: 1
1427 *****
1428 *          < *
1429 * ----- *
1430 * $----- *
1431 * X--&&-- *
1432 * --&&-- *
1433 *      * X**
1434 *****
1435 Enter input: r
1436 Score: 0
1437 Items remaining: 1
1438 *****
1439 *          < *
1440 * ----- *
1441 * $----- *
1442 * X--&&-- *
1443 * --&&-- *
1444 *      * X**
1445 *****
1446 Enter input: e
1447 Score: 0
1448 Items remaining: 1
1449 *****
1450 *          < *
1451 * ----- *
1452 * $----- *
1453 * X--&&-- *
1454 * --&&-- *
1455 *      * X**
1456 *****
1457 Enter input: w
1458 Score: 0
1459 Items remaining: 1
1460 *****
1461 *          *
1462 * -----< *
1463 * $----- *
1464 * X--&&-- *
1465 * --&&-- *
1466 *      * X**
1467 *****
1468 Enter input: e
1469 Score: 0
1470 Items remaining: 1
1471 *****
1472 *          < *
1473 * ----- *
1474 * $----- *
1475 * X--&&-- *
1476 * --&&-- *
1477 *      * X**
1478 *****

```

```

1479 Enter input: s
1480 You have quit.
1481 Final score: 0
1482 $ cat game3.txt
1483 1 4
1484
1485 a b 0 0
1486 E 0 2
1487 I 0 3
1488 P 0 1
1489 $ ./main game3.txt          # Example in which I waste all seven moves of the power orb running
    against a wall.
1490 Score: 0
1491 Items remaining: 1
1492 *****
1493 *a*X$*
1494 *****
1495 Enter input: d
1496 Score: 0
1497 Items remaining: 1
1498 *****
1499 * bX$*
1500 *****
1501 Enter input: s
1502 Score: 0
1503 Items remaining: 1
1504 *****
1505 * bX$*
1506 *****
1507 Enter input: s
1508 Score: 0
1509 Items remaining: 1
1510 *****
1511 * bX$*
1512 *****
1513 Enter input: s
1514 Score: 0
1515 Items remaining: 1
1516 *****
1517 * bX$*
1518 *****
1519 Enter input: s
1520 Score: 0
1521 Items remaining: 1
1522 *****
1523 * bX$*
1524 *****
1525 Enter input: s
1526 Score: 0
1527 Items remaining: 1
1528 *****
1529 * bX$*
1530 *****
1531 Enter input: s
1532 Score: 0
1533 Items remaining: 1
1534 *****
1535 * bX$*
1536 *****
1537 Enter input: s
1538 Score: 0
1539 Items remaining: 1
1540 *****
1541 * aX$*
1542 *****
1543 Enter input: d
1544 Score: 0
1545 Items remaining: 1
1546 *****
1547 * @X$*
1548 *****
1549 You have died.
1550 Final score: 0
1551 $ ./main game2.txt          # Example in which I replenish the duration of power mode by

```



grabbing another power orb.

```
1552 Score: 0
1553 Items remaining: 1
1554 *****
1555 *          <*
1556 * ----- *
1557 *$----- *
1558 *X--&&-- *
1559 * --&&-- *
1560 *      * X**
1561 *****
1562 Enter input: w
1563 Score: 0
1564 Items remaining: 1
1565 *****
1566 *          *
1567 * -----<*
1568 *$----- *
1569 *X--&&-- *
1570 * --&&-- *
1571 *      * X**
1572 *****
1573 Enter input: w
1574 Score: 0
1575 Items remaining: 1
1576 *****
1577 *          *
1578 * ----- *
1579 *$-----<*
1580 *X--&&-- *
1581 * --&&-- *
1582 *      * X**
1583 *****
1584 Enter input: w
1585 Score: 0
1586 Items remaining: 1
1587 *****
1588 *          *
1589 * ----- *
1590 *$----- *
1591 *X--&&--<*
1592 * --&&-- *
1593 *      * X**
1594 *****
1595 Enter input: w
1596 Score: 0
1597 Items remaining: 1
1598 *****
1599 *          *
1600 * ----- *
1601 *$----- *
1602 *X--&&-- *
1603 * --&&--<*
1604 *      * X**
1605 *****
1606 Enter input: w
1607 Score: 0
1608 Items remaining: 1
1609 *****
1610 *          *
1611 * ----- *
1612 *$----- *
1613 *X--&&-- *
1614 * --&&-- *
1615 *      * XC*
1616 *****
1617 Enter input: q
1618 Score: 1
1619 Items remaining: 1
1620 *****
1621 *          *
1622 * ----- *
1623 *$----- *
1624 *X--&&-- *
```

```

1625 * --&&-- *
1626 *      * C *
1627 *****
1628 Enter input: q
1629 Score: 1
1630 Items remaining: 1
1631 *****
1632 *          *
1633 * ----- *
1634 *$----- *
1635 *X--&&-- *
1636 * --&&-- *
1637 *      *C *
1638 *****
1639 Enter input: q
1640 Score: 1
1641 Items remaining: 1
1642 *****
1643 *          *
1644 * ----- *
1645 *$----- *
1646 *X--&&-- *
1647 * --&&-- *
1648 *      *C *
1649 *****
1650 Enter input: q
1651 Score: 1
1652 Items remaining: 1
1653 *****
1654 *          *
1655 * ----- *
1656 *$----- *
1657 *X--&&-- *
1658 * --&&-- *
1659 *      *C *
1660 *****
1661 Enter input: q
1662 Score: 1
1663 Items remaining: 1
1664 *****
1665 *          *
1666 * ----- *
1667 *$----- *
1668 *X--&&-- *
1669 * --&&-- *
1670 *      *C *
1671 *****
1672 Enter input: q
1673 Score: 1
1674 Items remaining: 1
1675 *****
1676 *          *
1677 * ----- *
1678 *$----- *
1679 *X--&&-- *
1680 * --&&-- *
1681 *      *C *
1682 *****
1683 Enter input: q
1684 Score: 1
1685 Items remaining: 1
1686 *****
1687 *          *
1688 * ----- *
1689 *$----- *
1690 *X--&&-- *
1691 * --&&-- *
1692 *C          *
1693 *****
1694 Enter input: e
1695 Score: 1
1696 Items remaining: 1
1697 *****
1698 *          *

```

```

1699 * ----- *
1700 *$----- *
1701 *X--&&-- *
1702 *C--&&-- *
1703 *         *
1704 *****
1705 Enter input: e
1706 Score: 2
1707 Items remaining: 1
1708 *****
1709 *         *
1710 * ----- *
1711 *$----- *
1712 *C--&&-- *
1713 * --&&-- *
1714 *         *
1715 *****
1716 Enter input: e
1717 Congratulations! You have won.
1718 Final score: 3
1719 $ ./main game3.txt                # Example in which I touch an enemy right as power mode ends,
                                     # resulting in my death.
1720 Score: 0
1721 Items remaining: 1
1722 *****
1723 *a*X$*
1724 *****
1725 Enter input: d
1726 Score: 0
1727 Items remaining: 1
1728 *****
1729 * bX$*
1730 *****
1731 Enter input: a
1732 Score: 0
1733 Items remaining: 1
1734 *****
1735 *b X$*
1736 *****
1737 Enter input: d
1738 Score: 0
1739 Items remaining: 1
1740 *****
1741 * bX$*
1742 *****
1743 Enter input: a
1744 Score: 0
1745 Items remaining: 1
1746 *****
1747 *b X$*
1748 *****
1749 Enter input: d
1750 Score: 0
1751 Items remaining: 1
1752 *****
1753 * bX$*
1754 *****
1755 Enter input: a
1756 Score: 0
1757 Items remaining: 1
1758 *****
1759 *b X$*
1760 *****
1761 Enter input: d
1762 Score: 0
1763 Items remaining: 1
1764 *****
1765 * bX$*
1766 *****
1767 Enter input: d
1768 Score: 0
1769 Items remaining: 1
1770 *****
1771 *  @$*

```

```
1772 *****
1773 You have died.
1774 Final score: 0
1775 $
```

