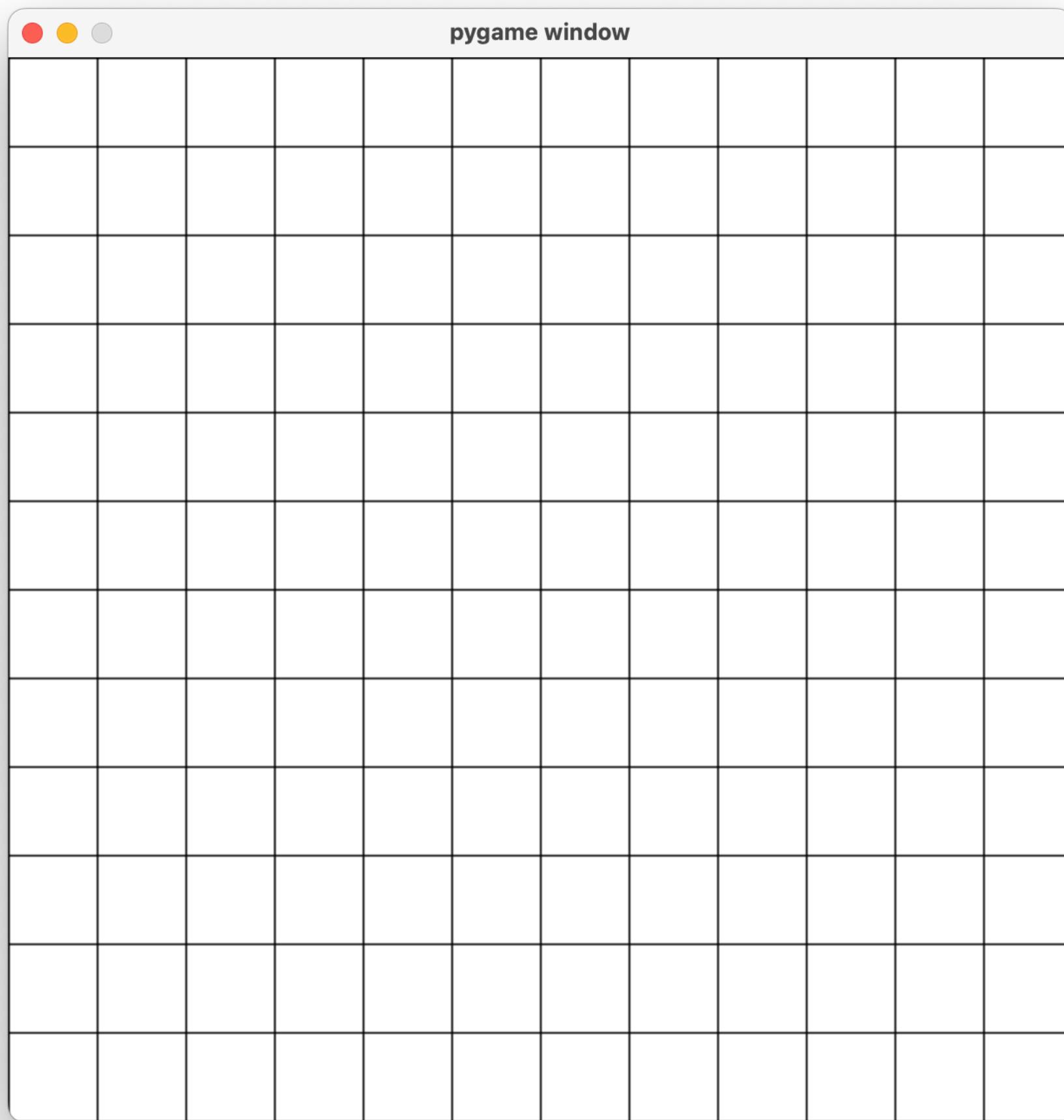
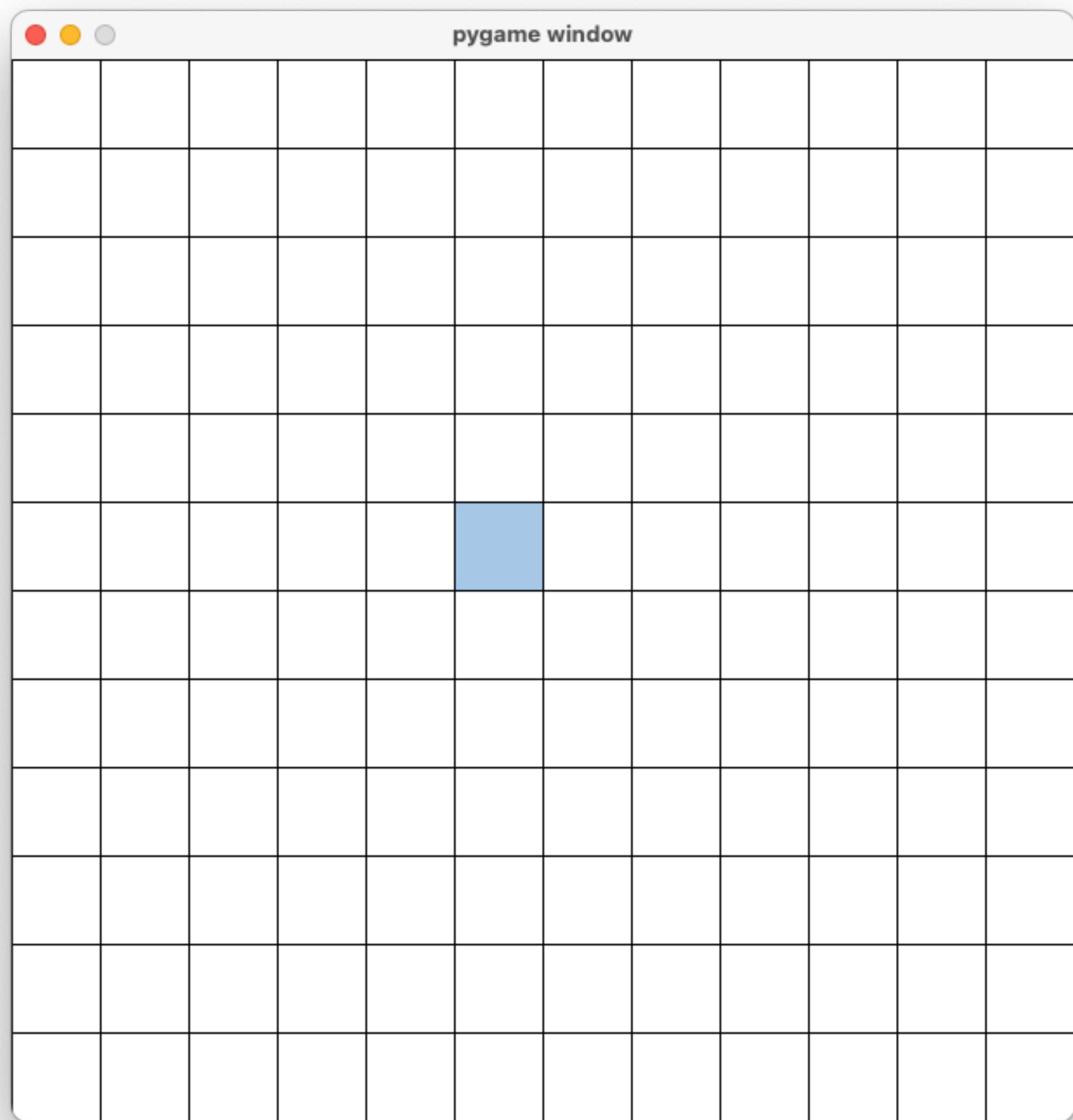
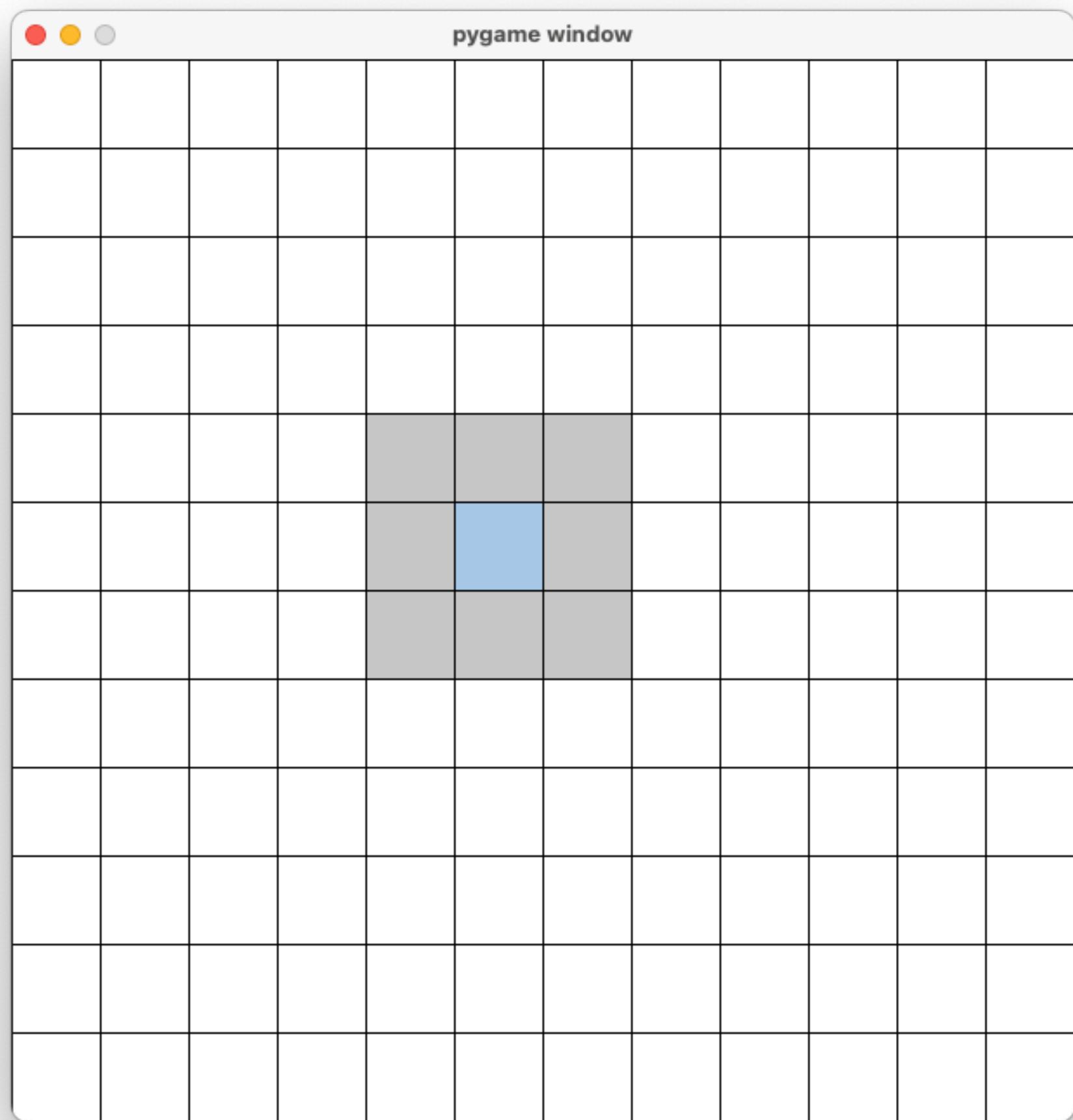


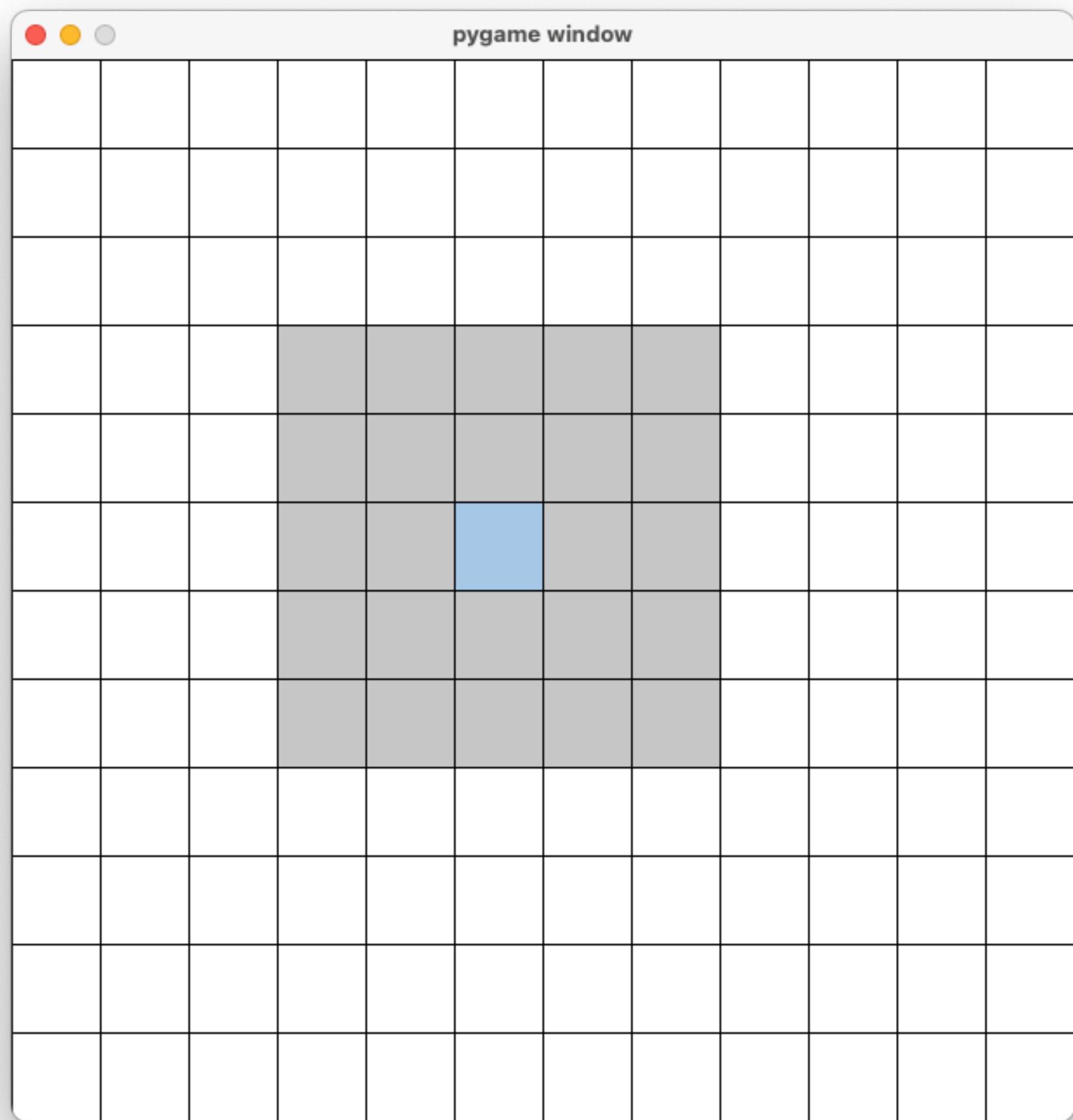
A close-up detail from a painting by Peter Paul Rubens, showing two cherubs. One cherub on the left is depicted from the chest up, looking thoughtfully upwards with his hand near his chin. He has light brown hair and a small tuft of dark hair on his forehead. A dark green wing is visible behind his head. The other cherub on the right is also shown from the chest up, looking towards the viewer with a neutral expression. He has light brown hair and a dark tuft on his forehead. A large, reddish-brown wing is visible behind his head. The background is a soft, blended wash of blues and greens.

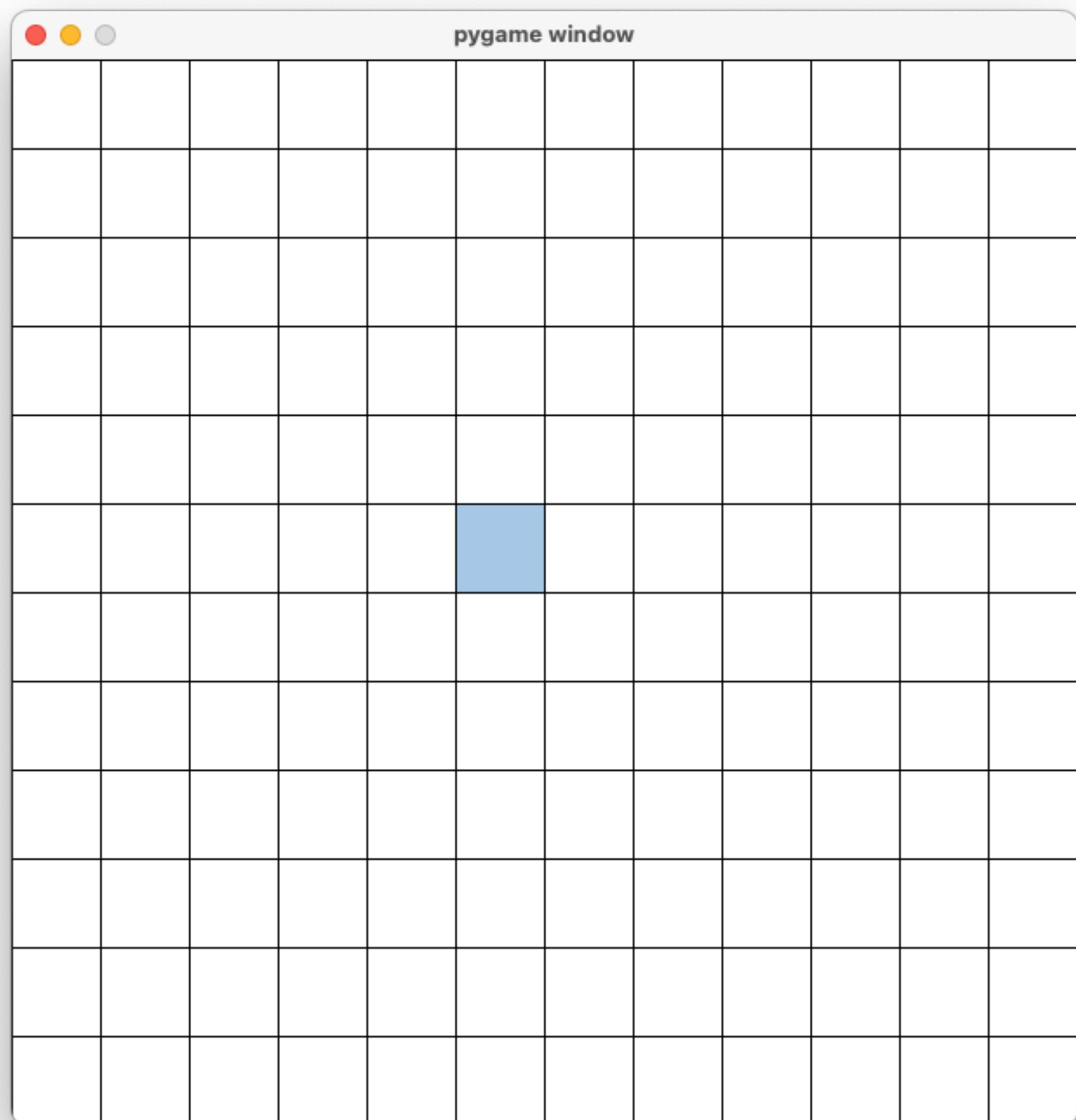
Le problème de l'ange

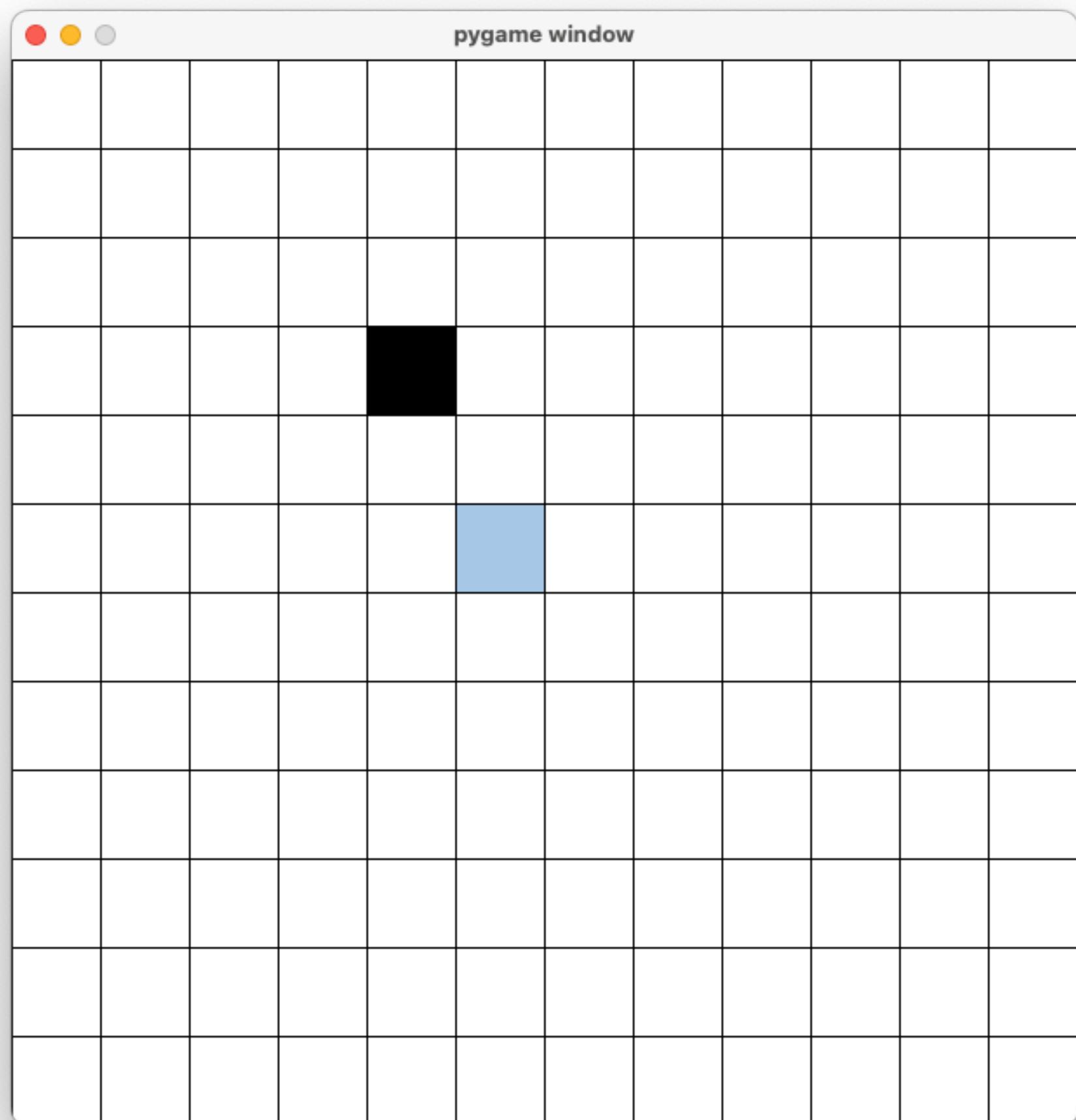


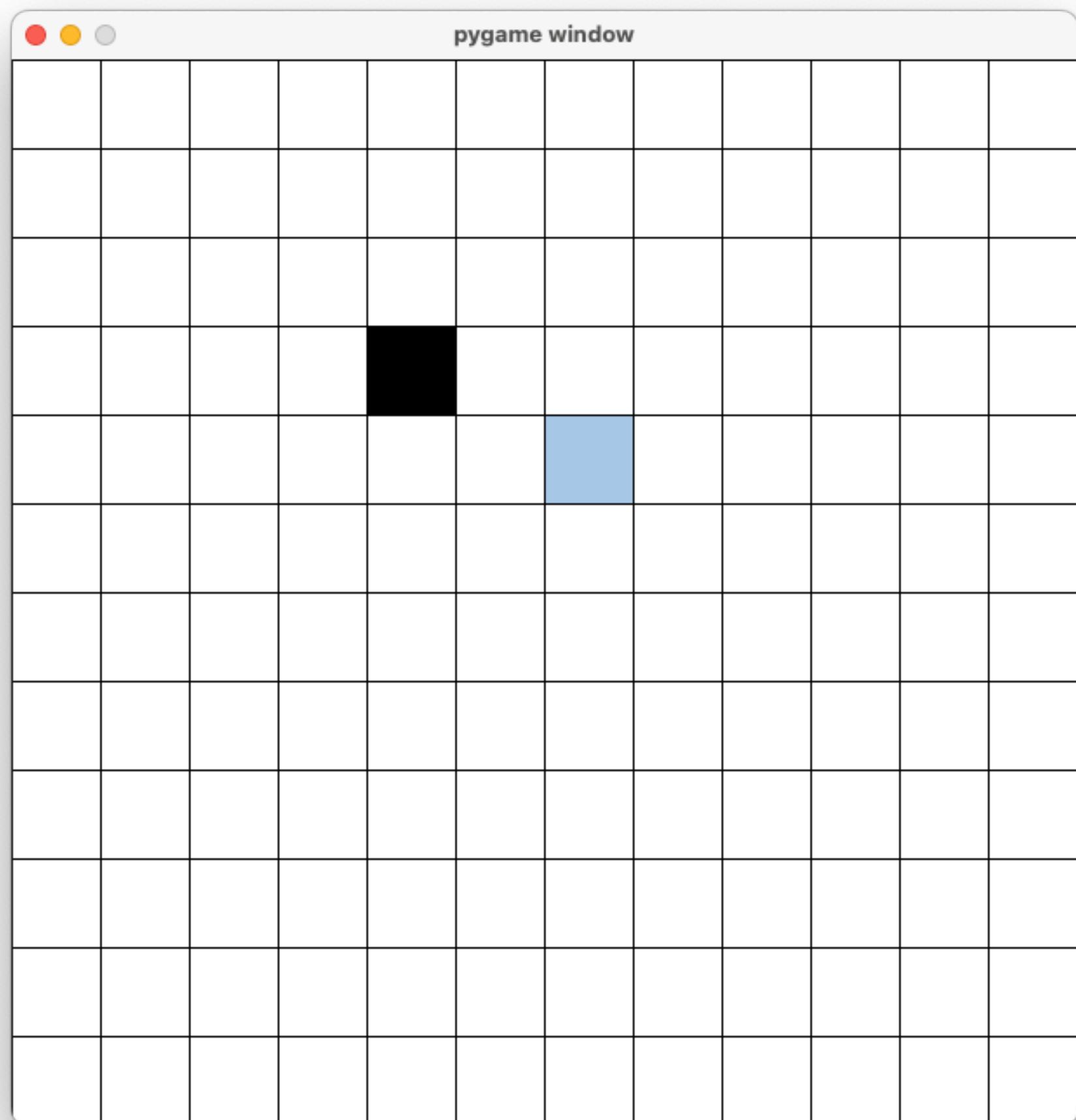


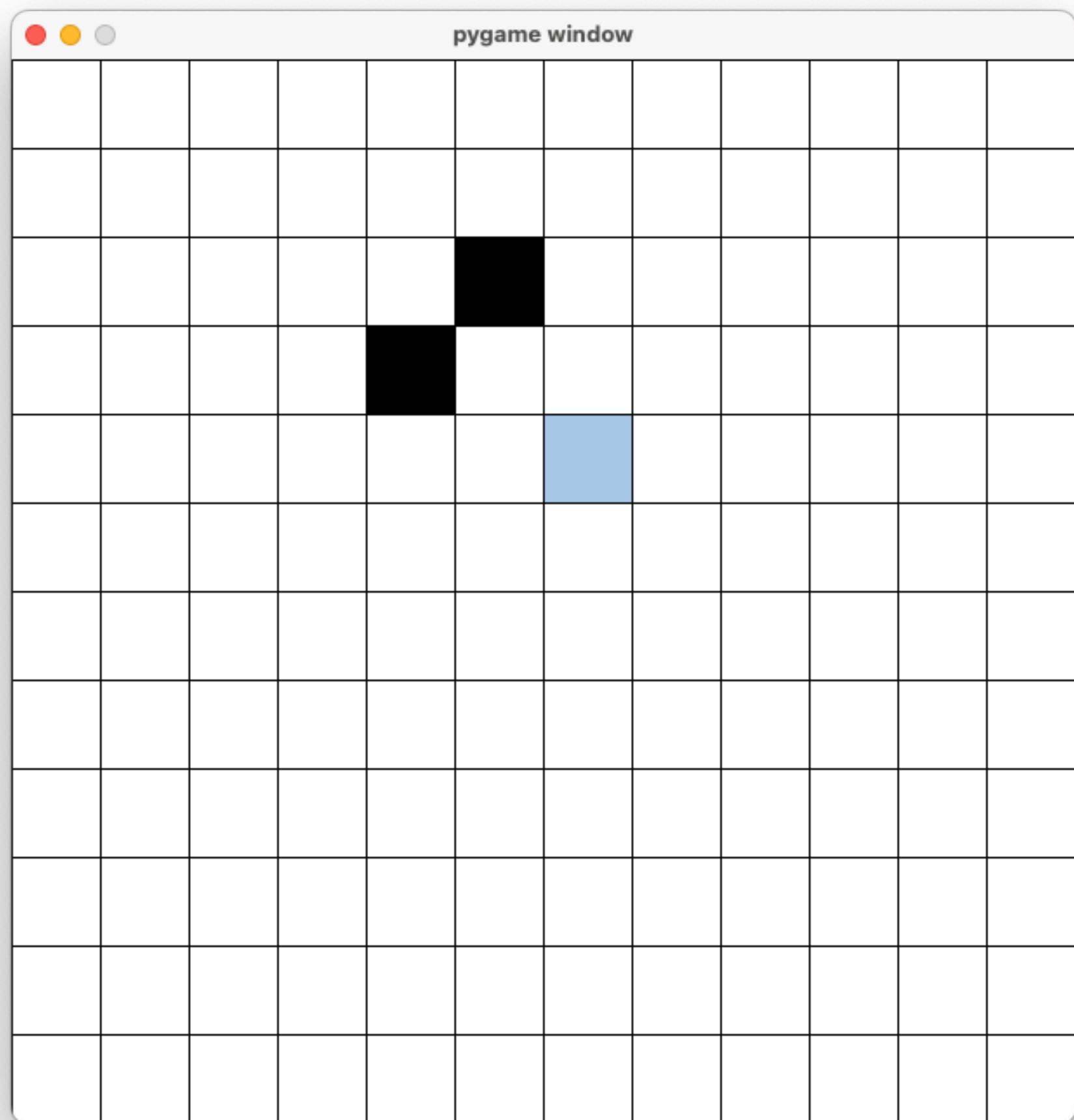




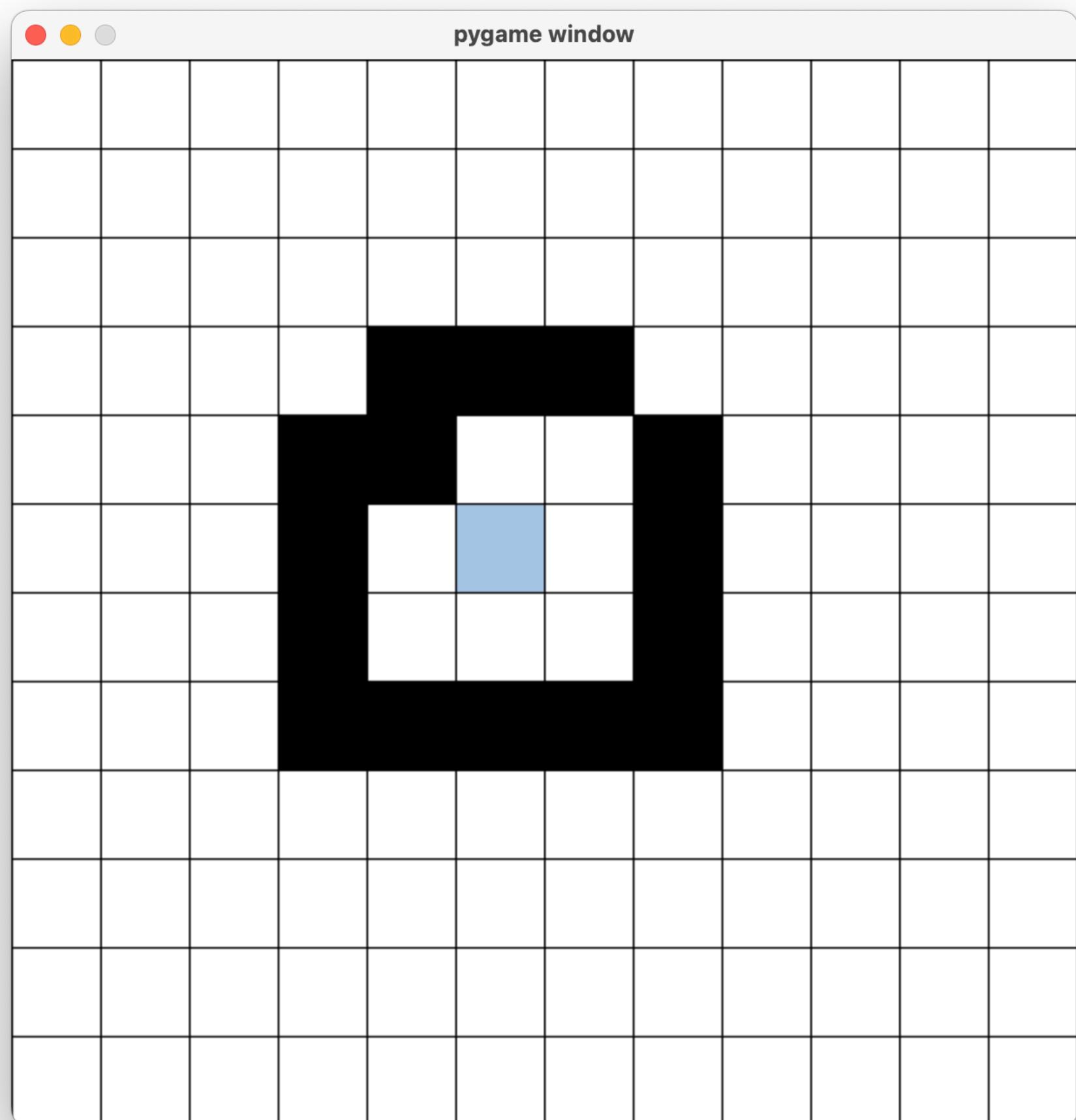


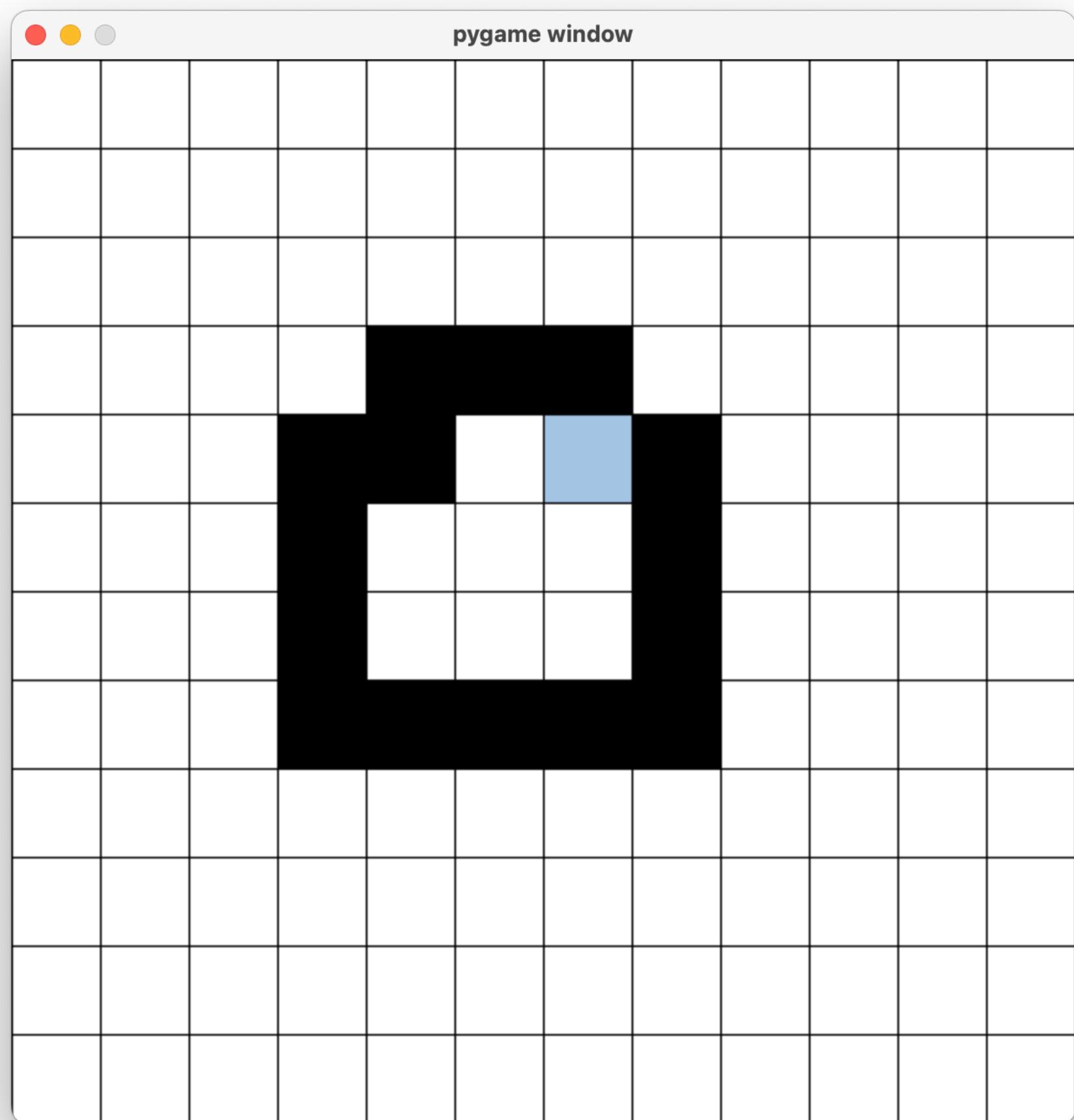


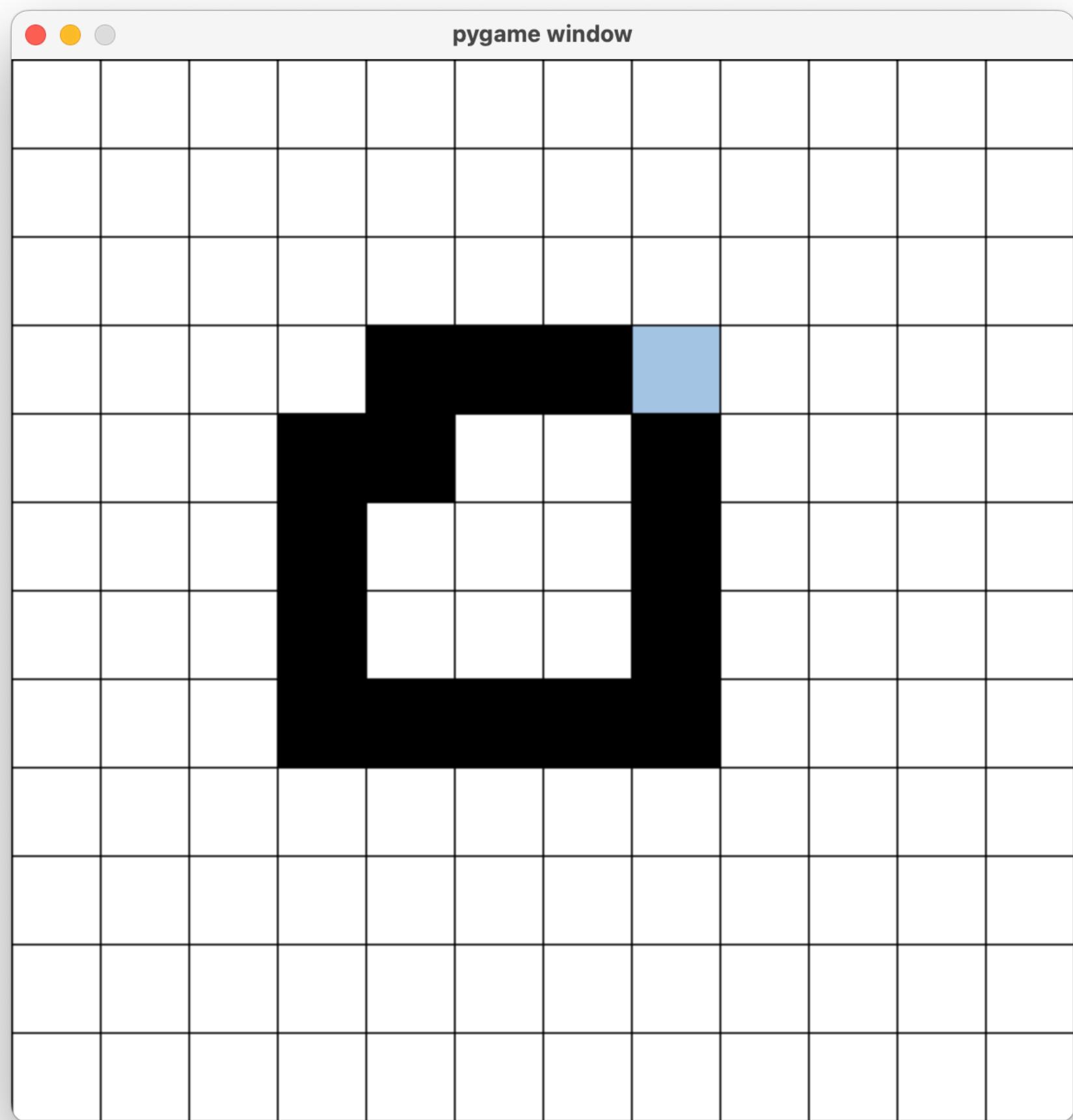


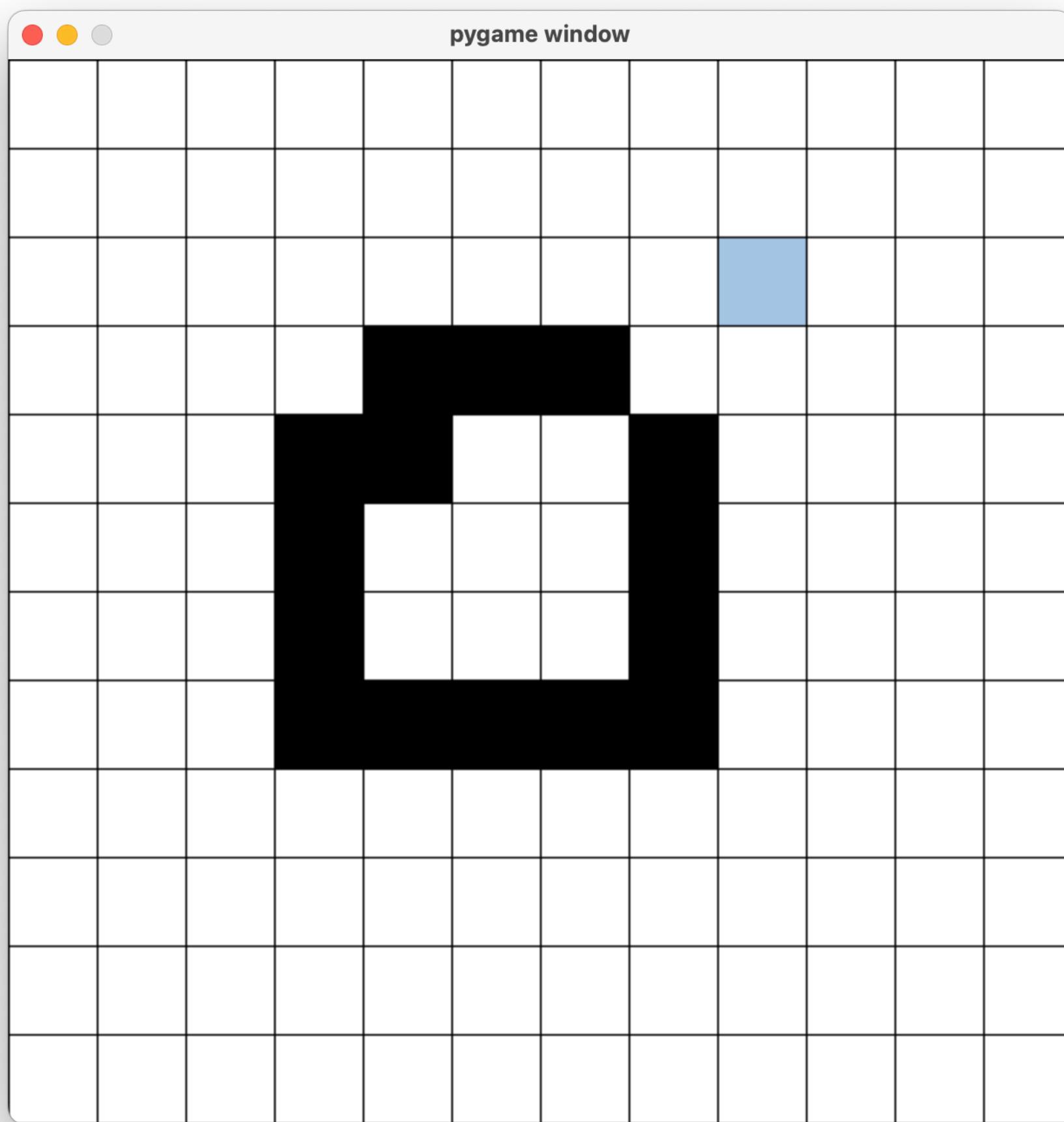


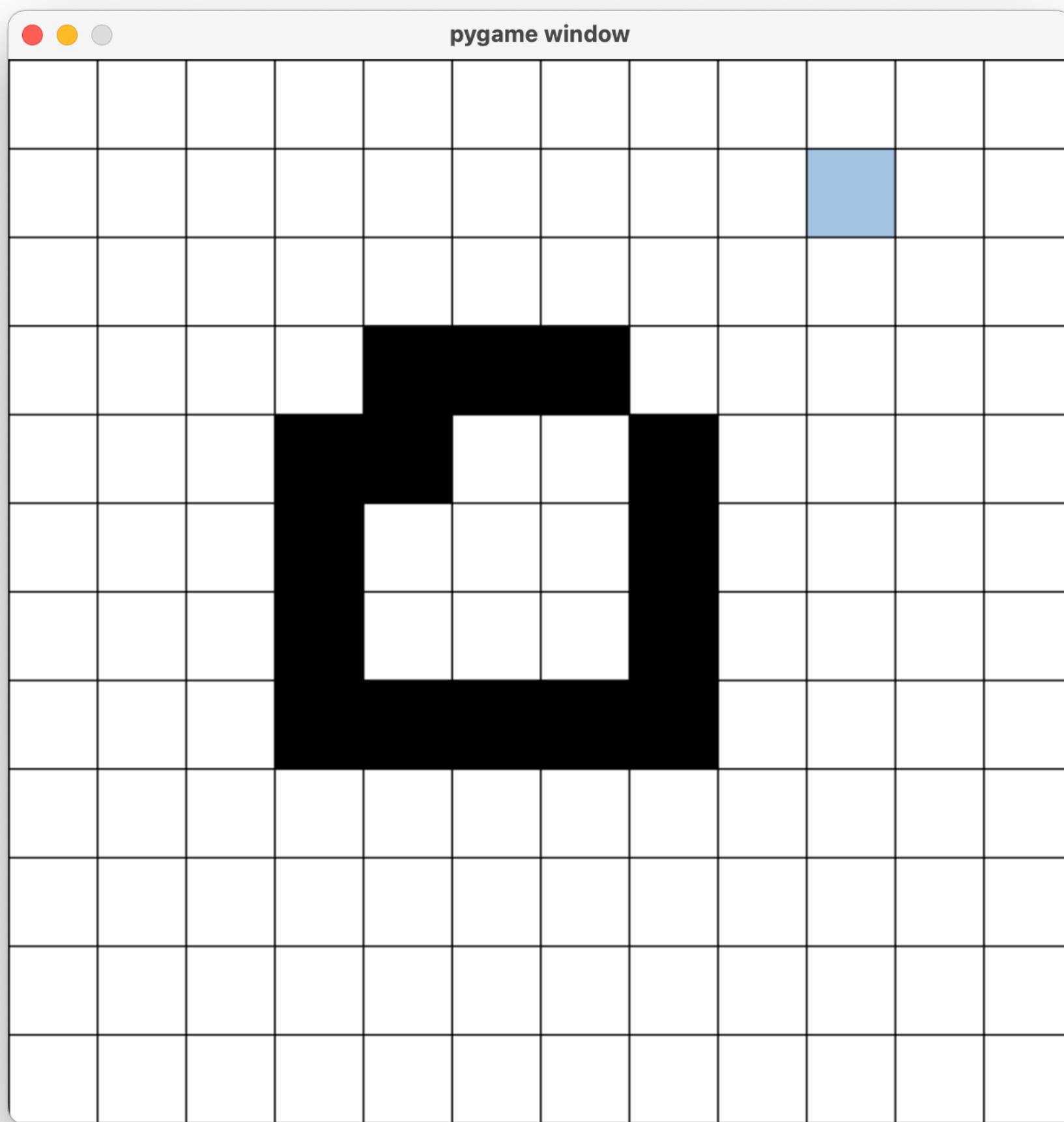
Comment on gagne?

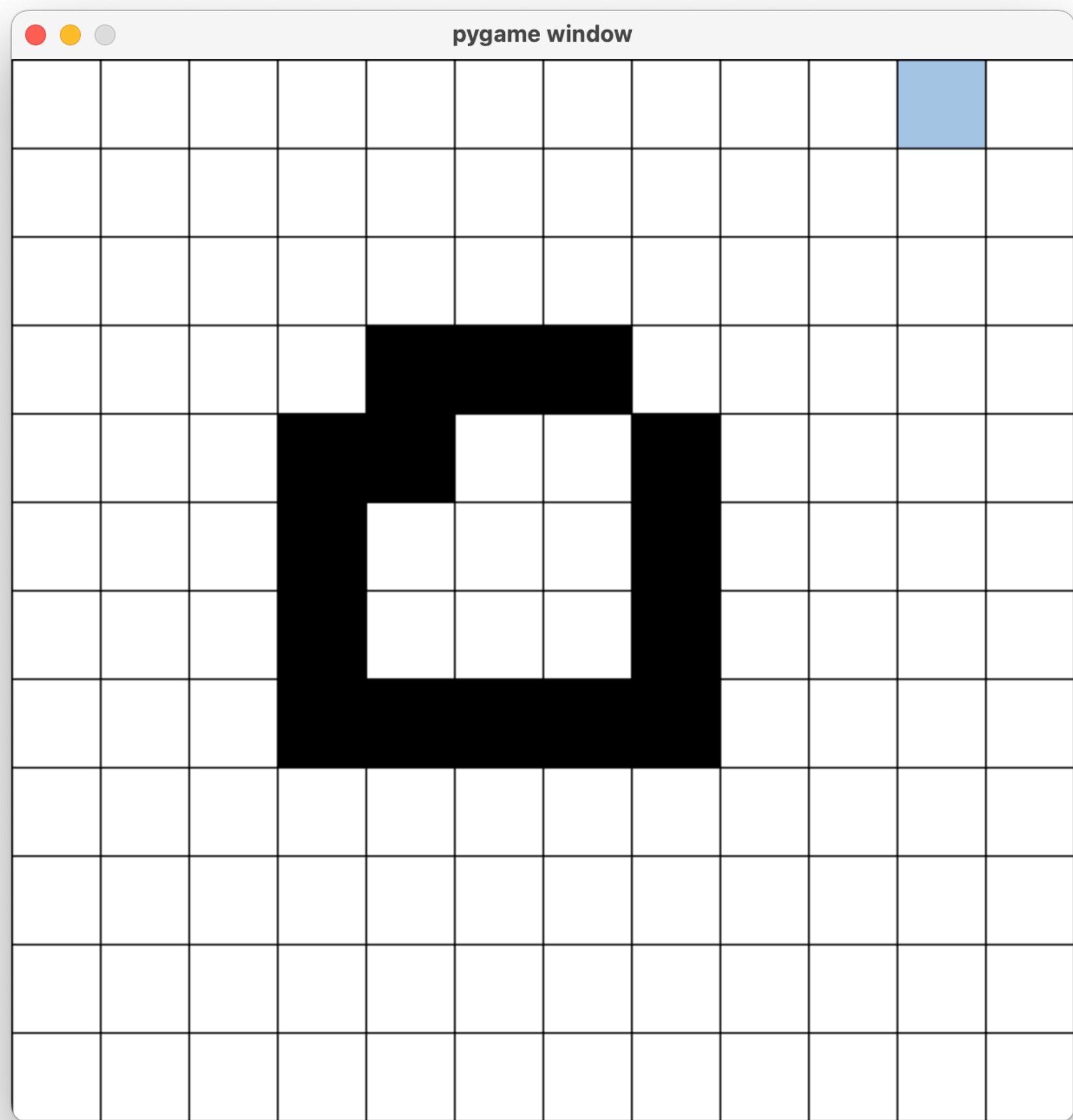


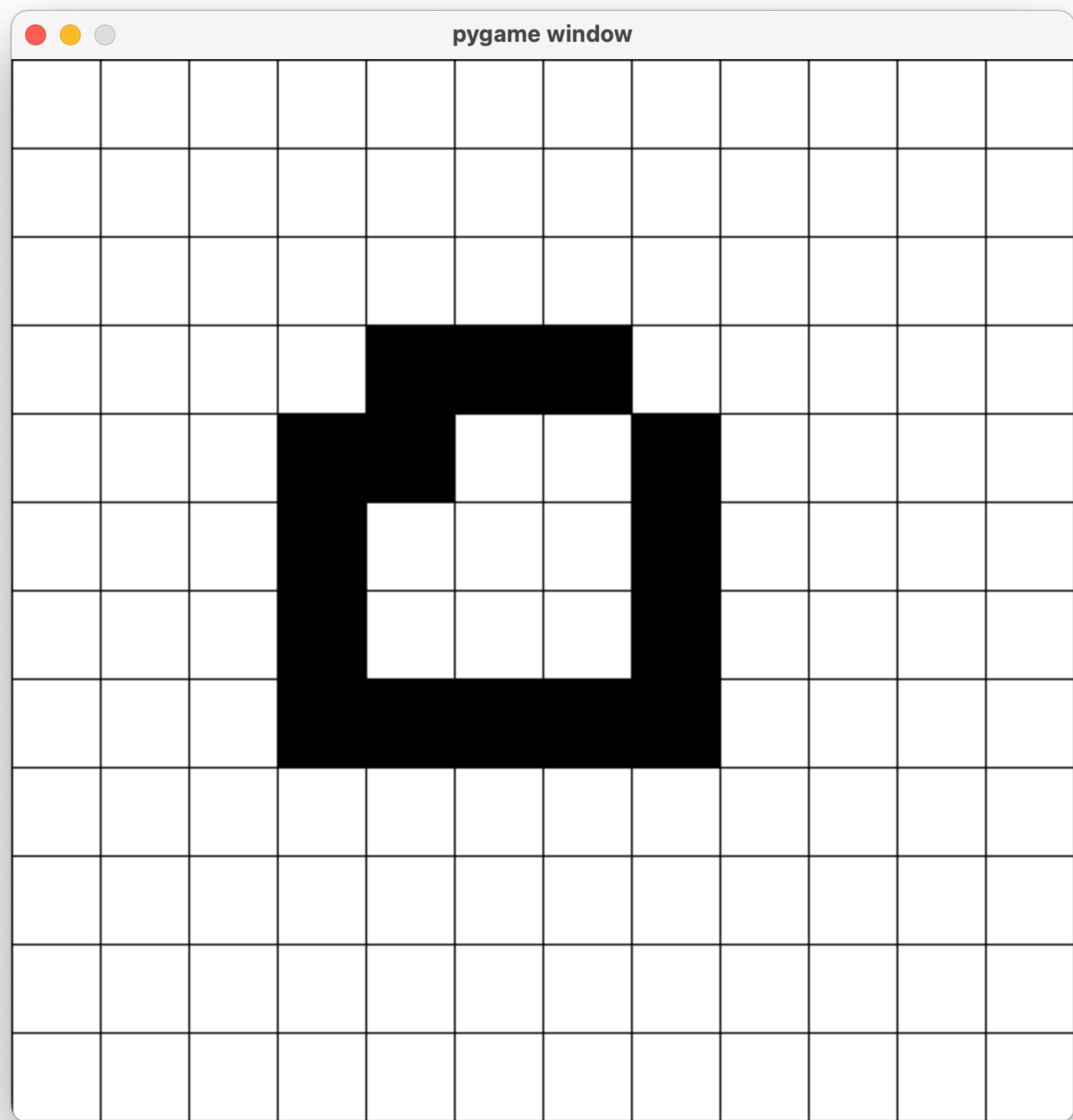


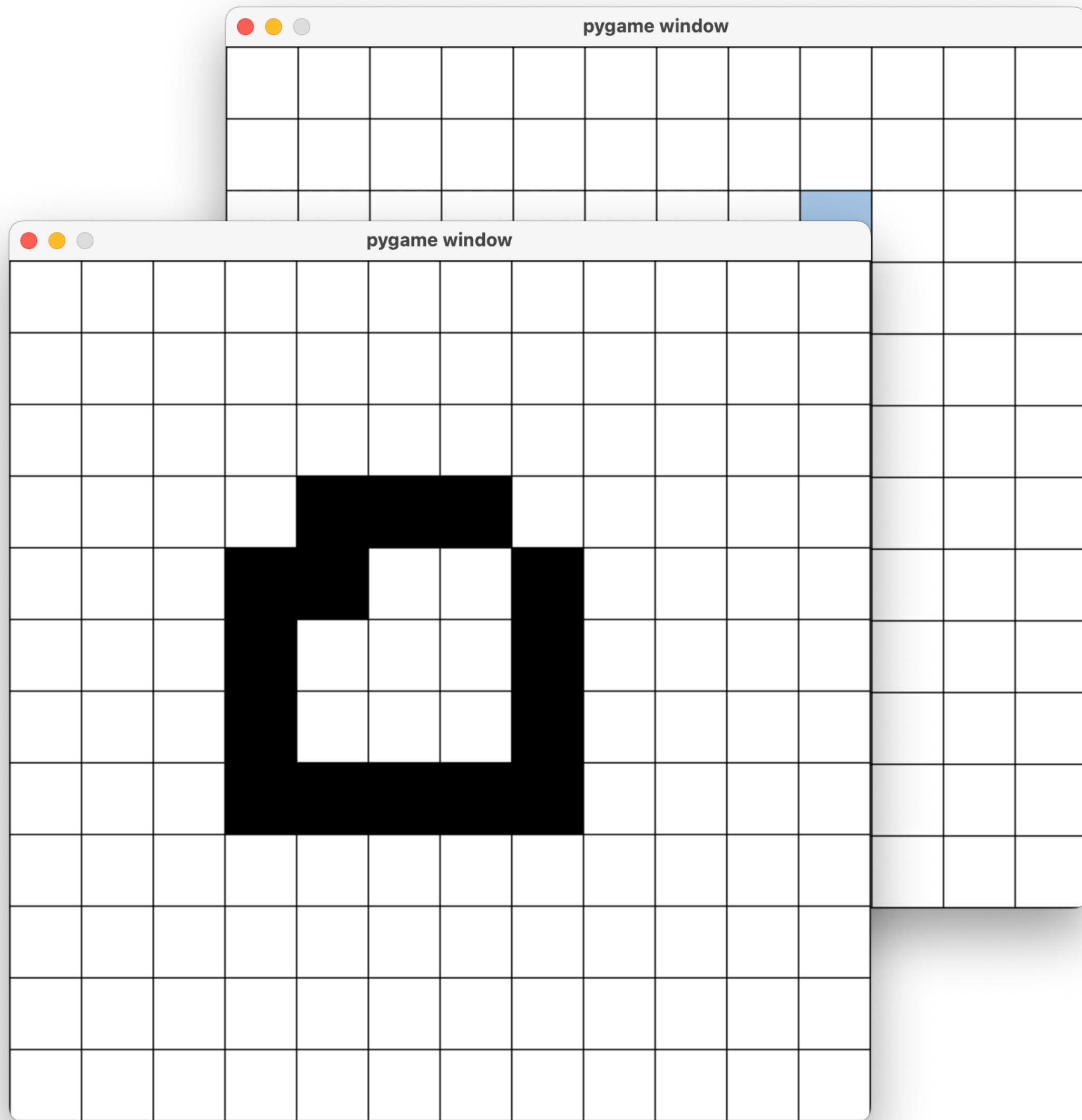


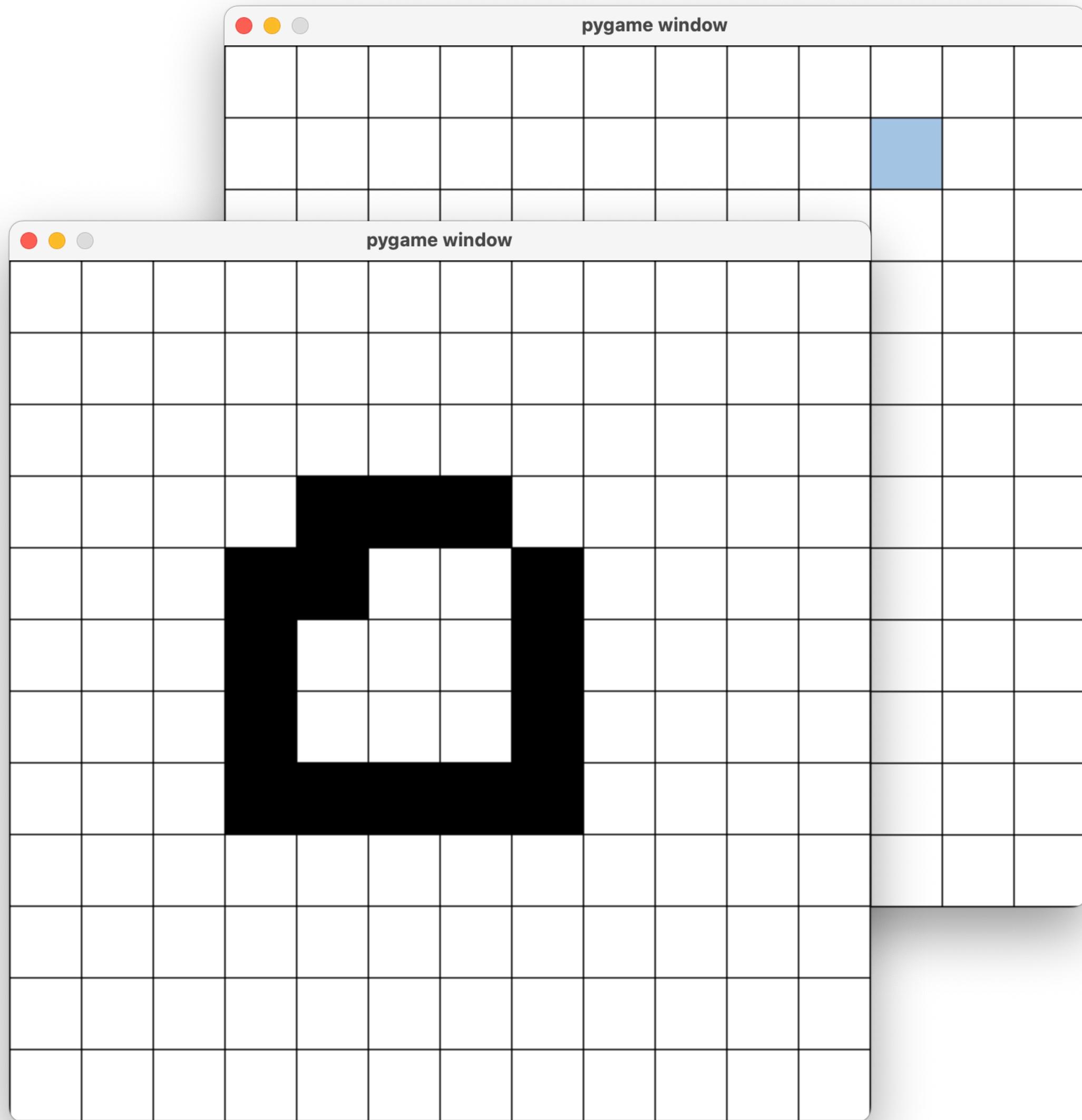








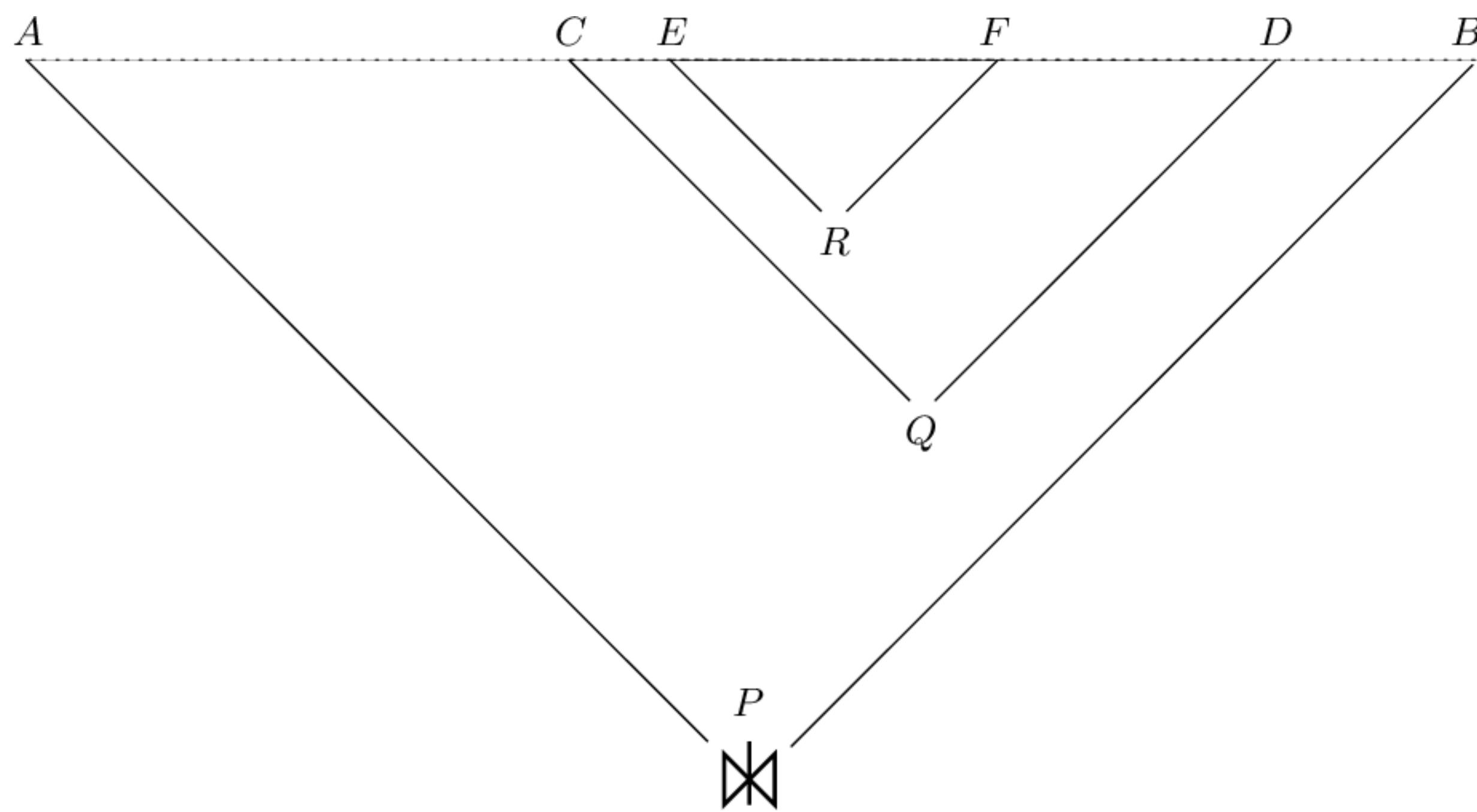




The Angel Problem

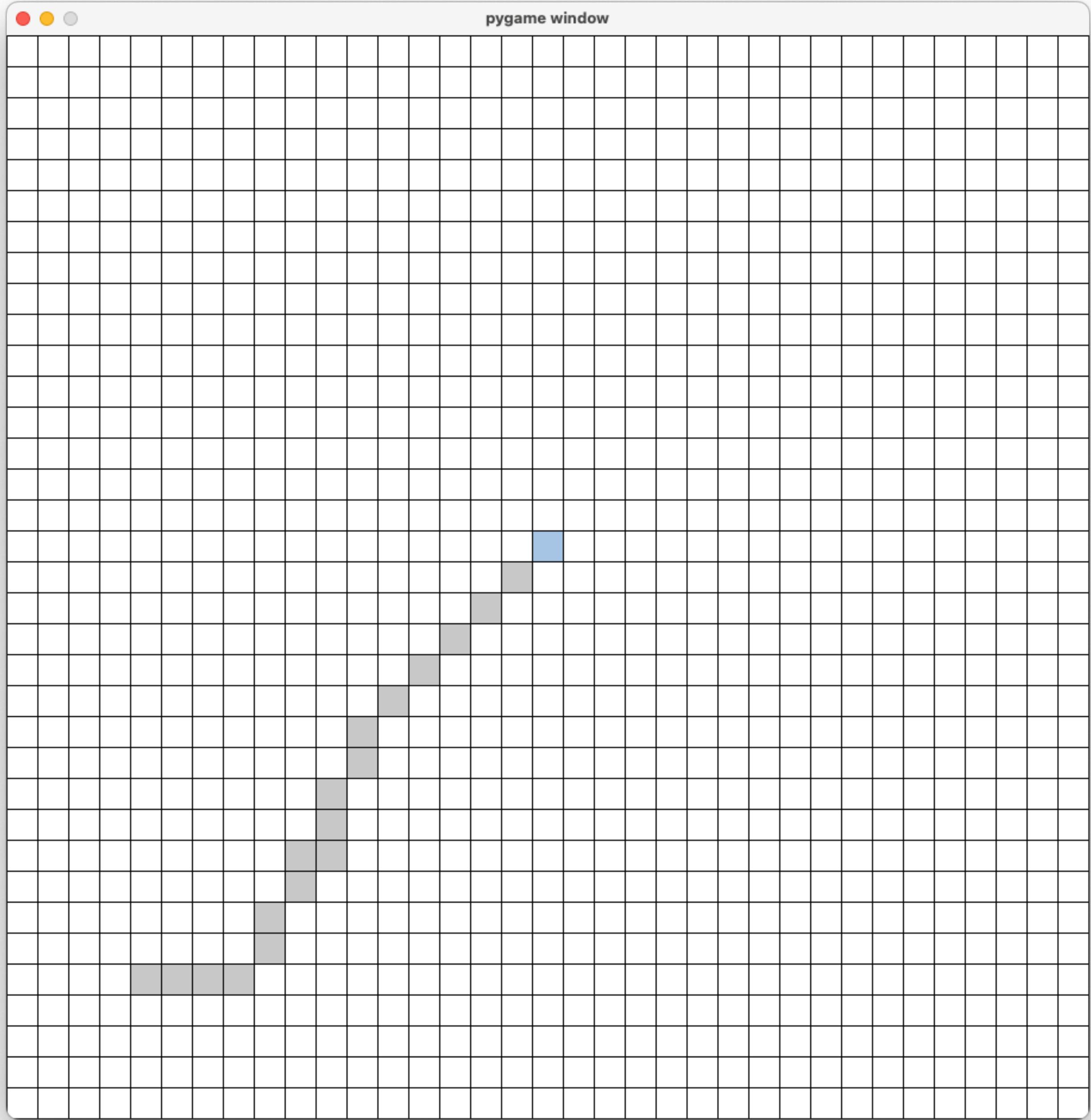
JOHN H. CONWAY

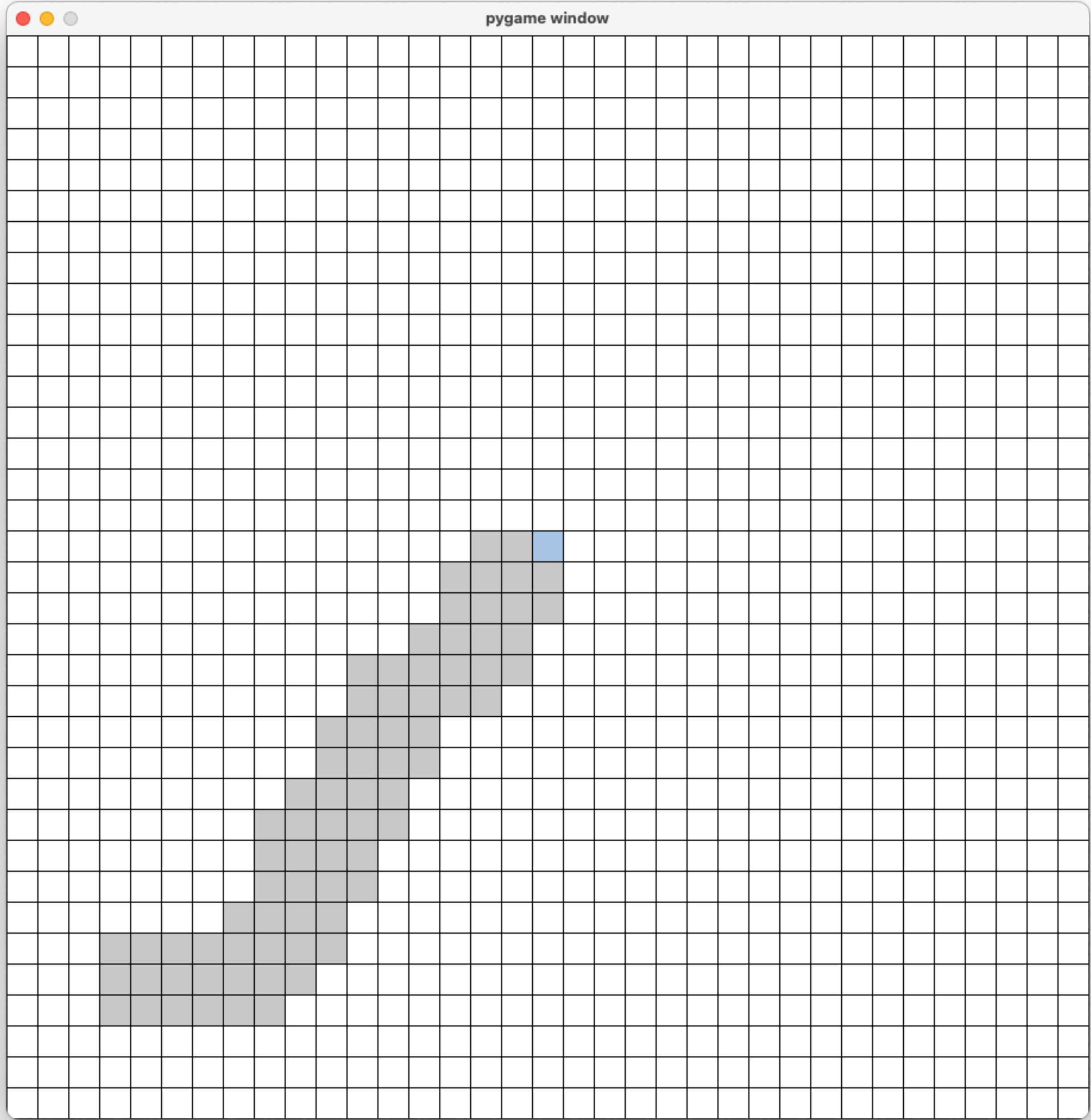
ABSTRACT. Can the Devil, who removes one square per move from an infinite chessboard, strand the Angel, who can jump up to 1000 squares per move? It seems unlikely, but the answer is unknown. Andreas Blass and I have proved that the Devil *can* strand an Angel who's handicapped in one of several ways. I end with a challenge for the solution the general problem.

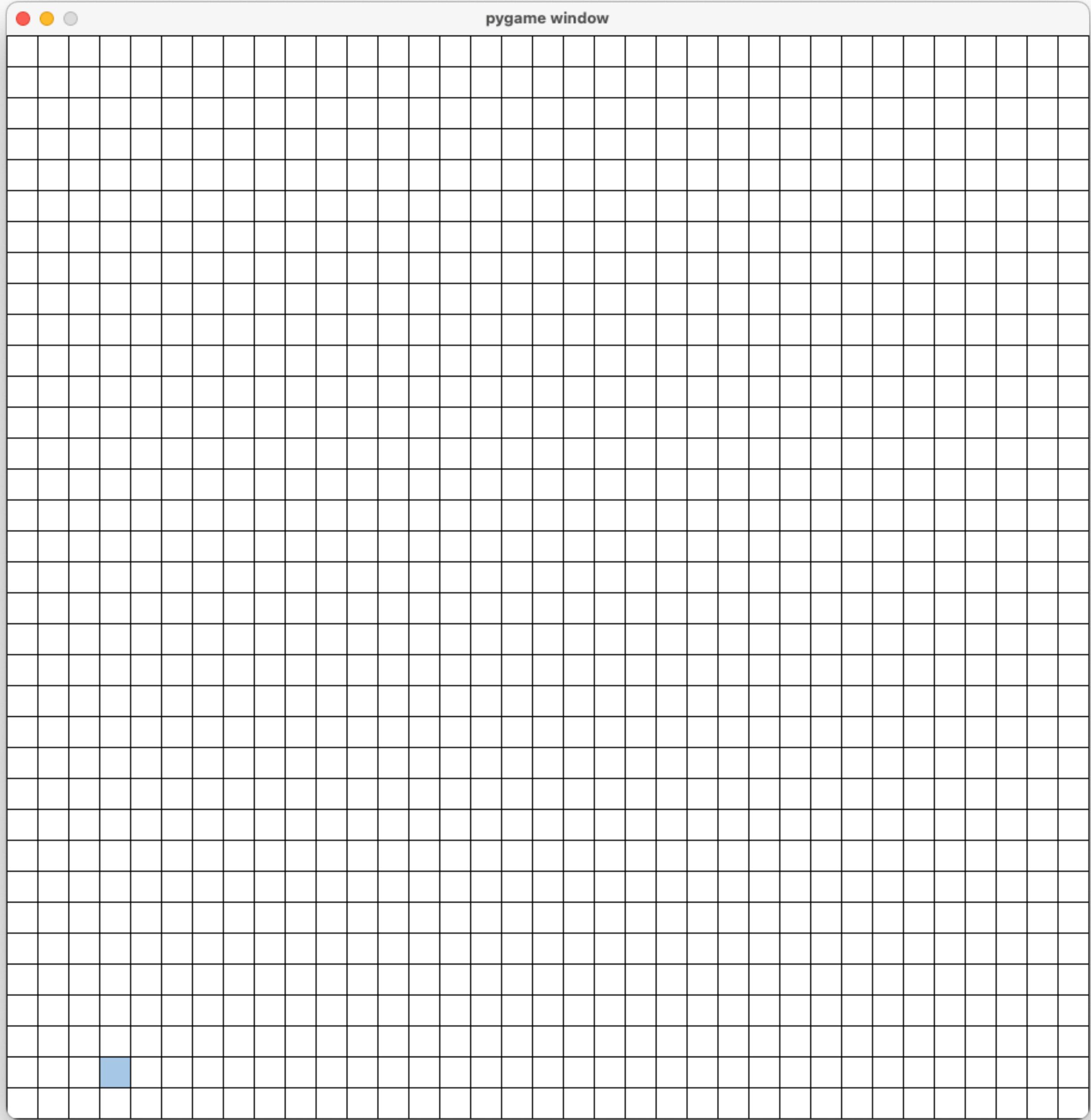


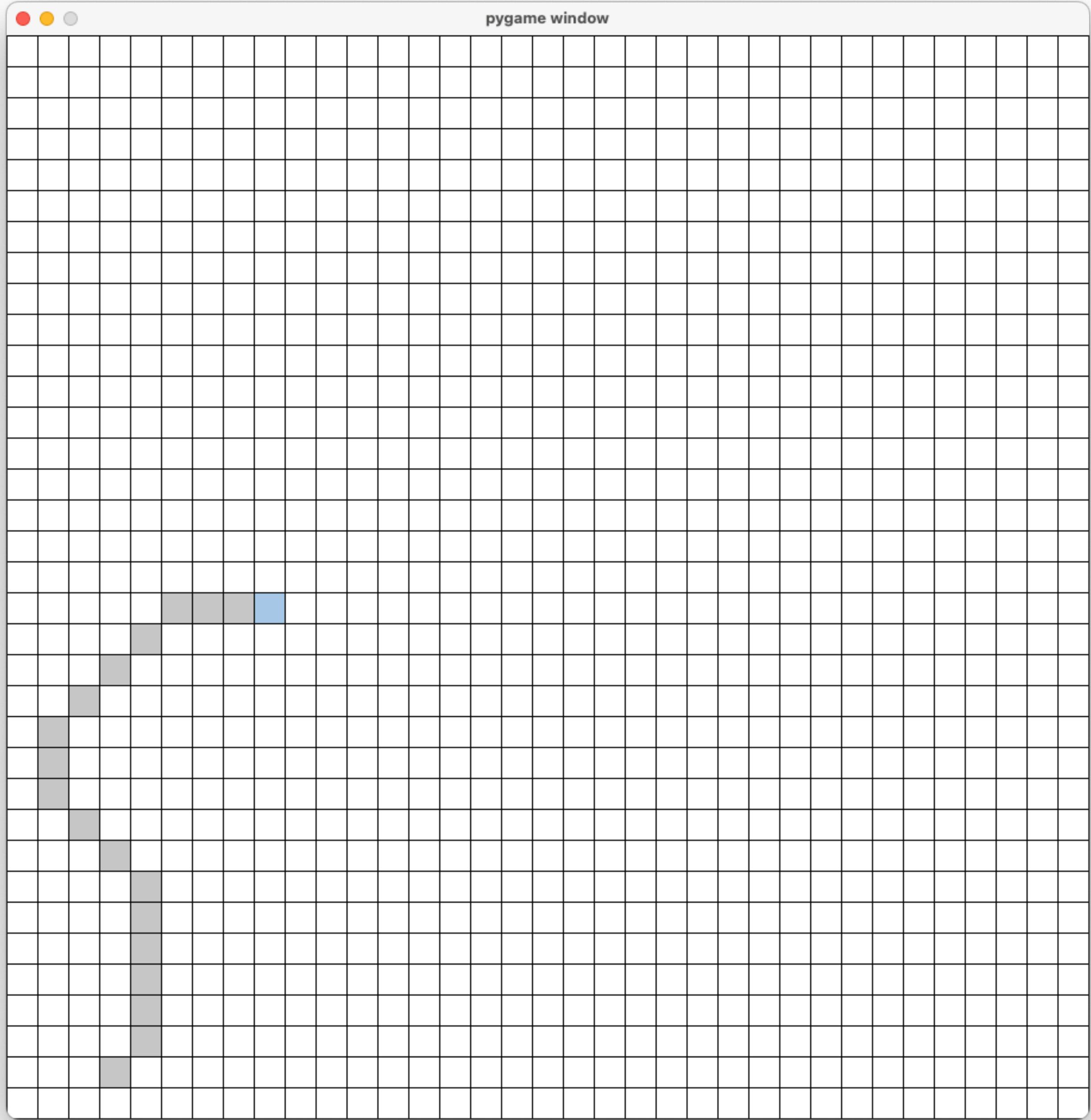
L'ange est son propre
pire ennemi.

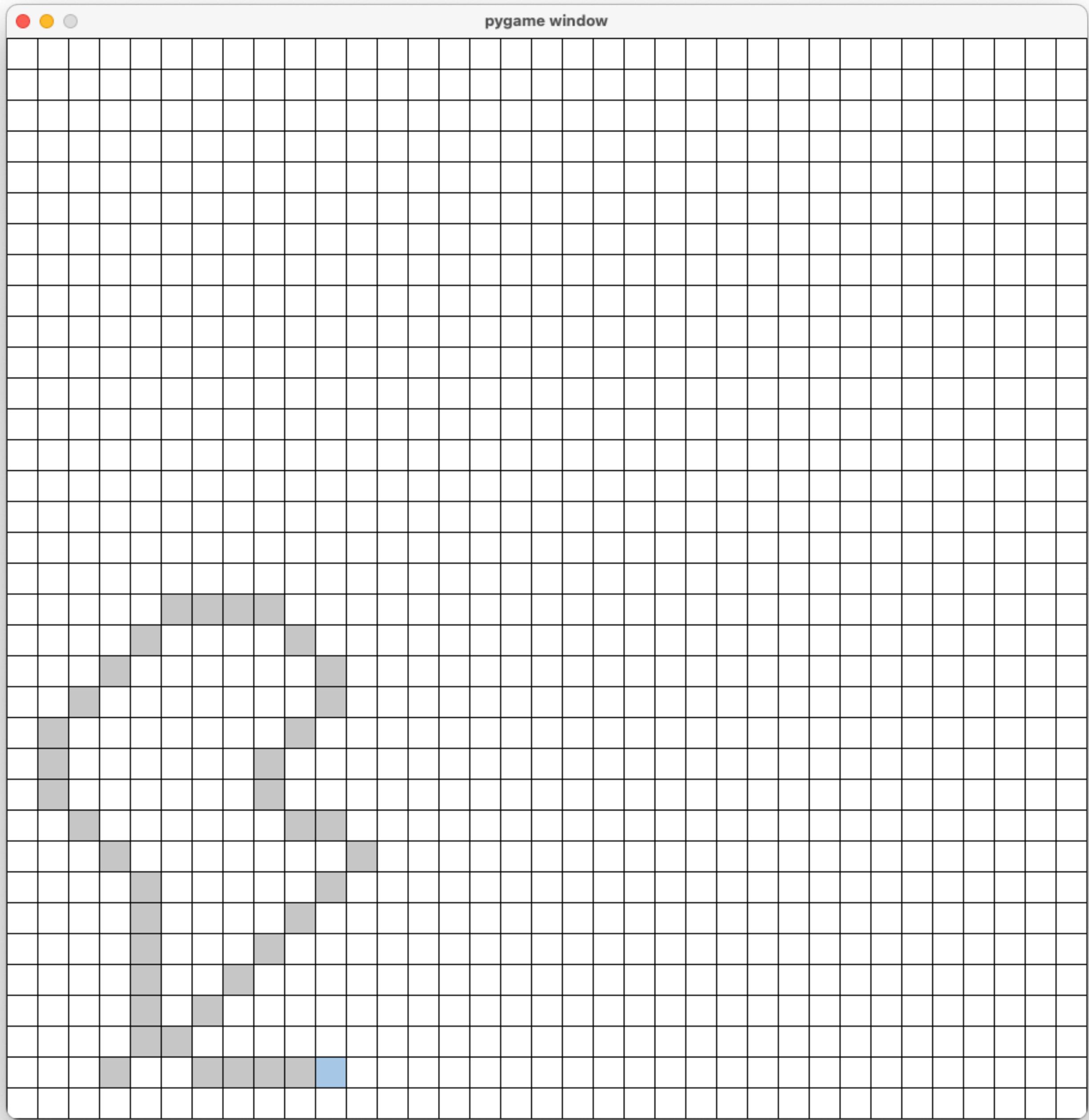
À toute fin utile, l'ange “brûle” les cases qu'il ne visite pas.



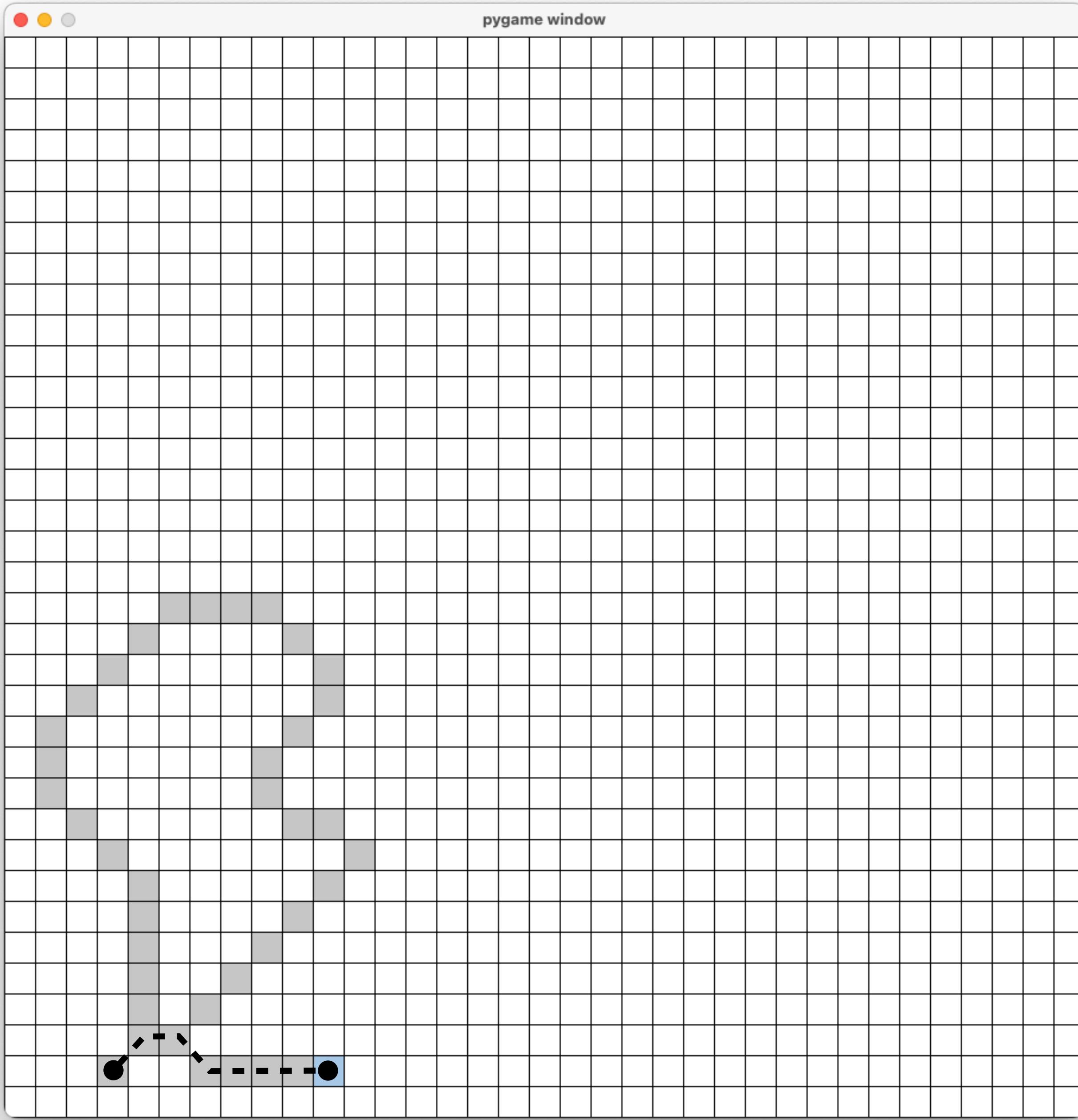








Chemin réduit

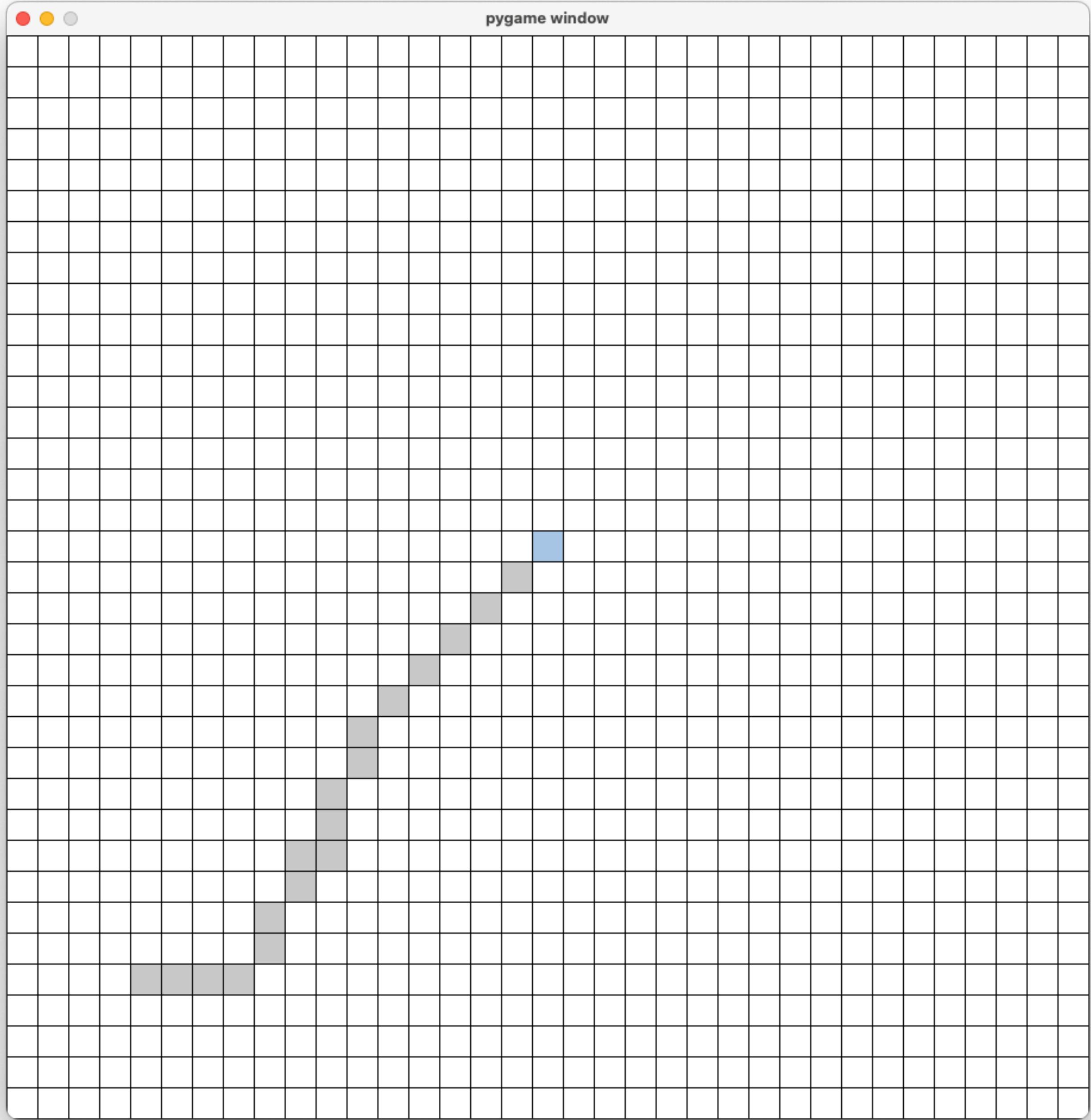


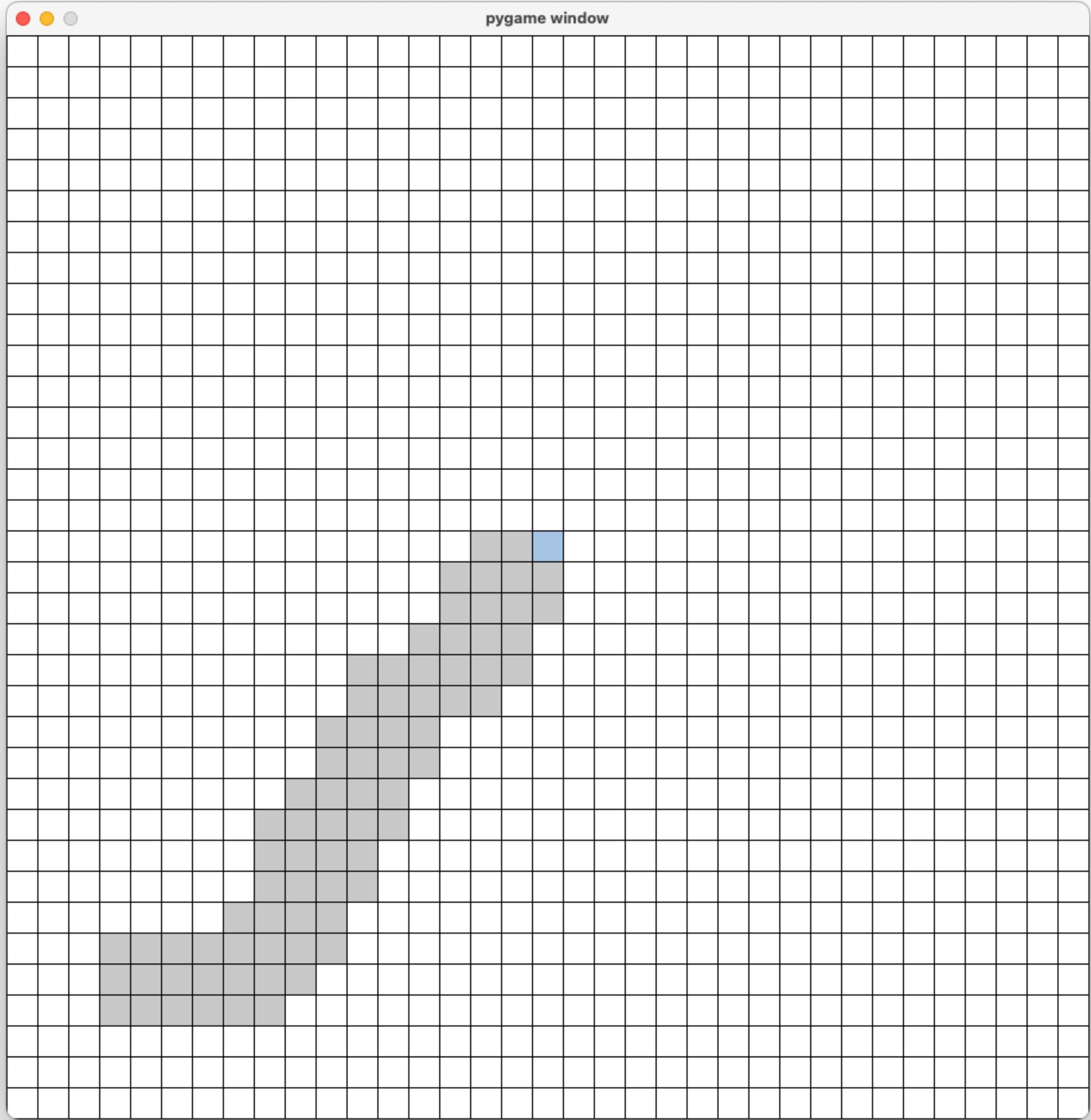
**Si ces cases sont inutiles pour l'ange,
elles sont inutiles pour le Diable.**

Le Gentil Diable



**Le Gentil Diable joue comme suit: à chaque tour,
il regarde là où est l'ange, calcule le chemin
réduit pour s'y rendre, et présente le chemin
réduit au Diable. Il lui demande: “Diable, si l'ange
avait pris ce chemin réduit, quelle case aurais-tu
brûlée?” Si c'est une case que le Gentil Diable ne
peut pas brûler, il ne fait rien, sinon il la brûle.**





Théorème. Si le Diable a une stratégie gagnante, le Gentil Diable a aussi une stratégie gagnante.

**Preuve. Nous allons démontrer
ceci à l'aide de la contraposition.**

**Nous voulons démontrer que:
Diable gagne \Rightarrow Gentil Diable gagne**

**La contraposition de cette
déclaration est:**

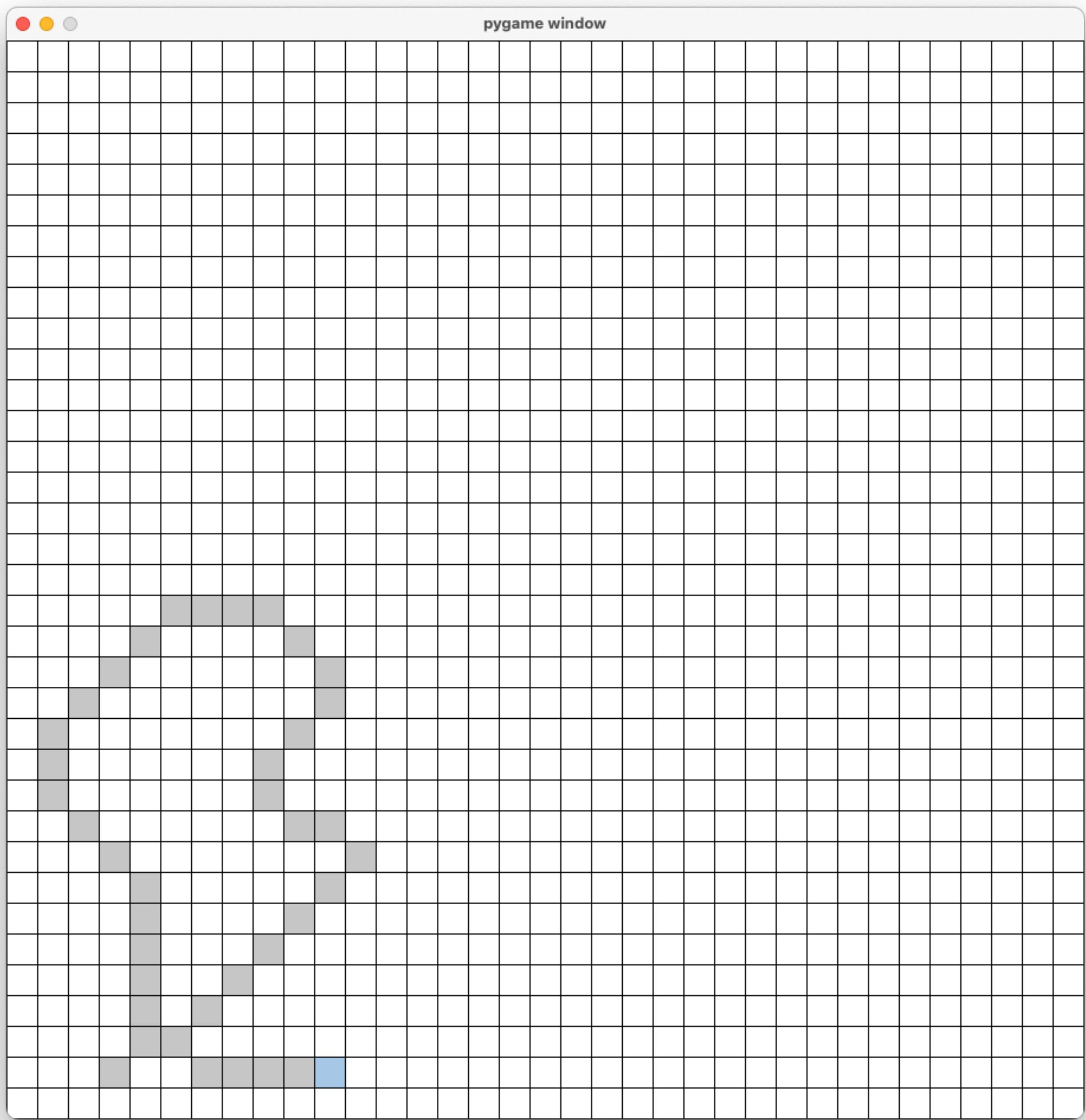
Gentil Diable perd \Rightarrow Diable perd

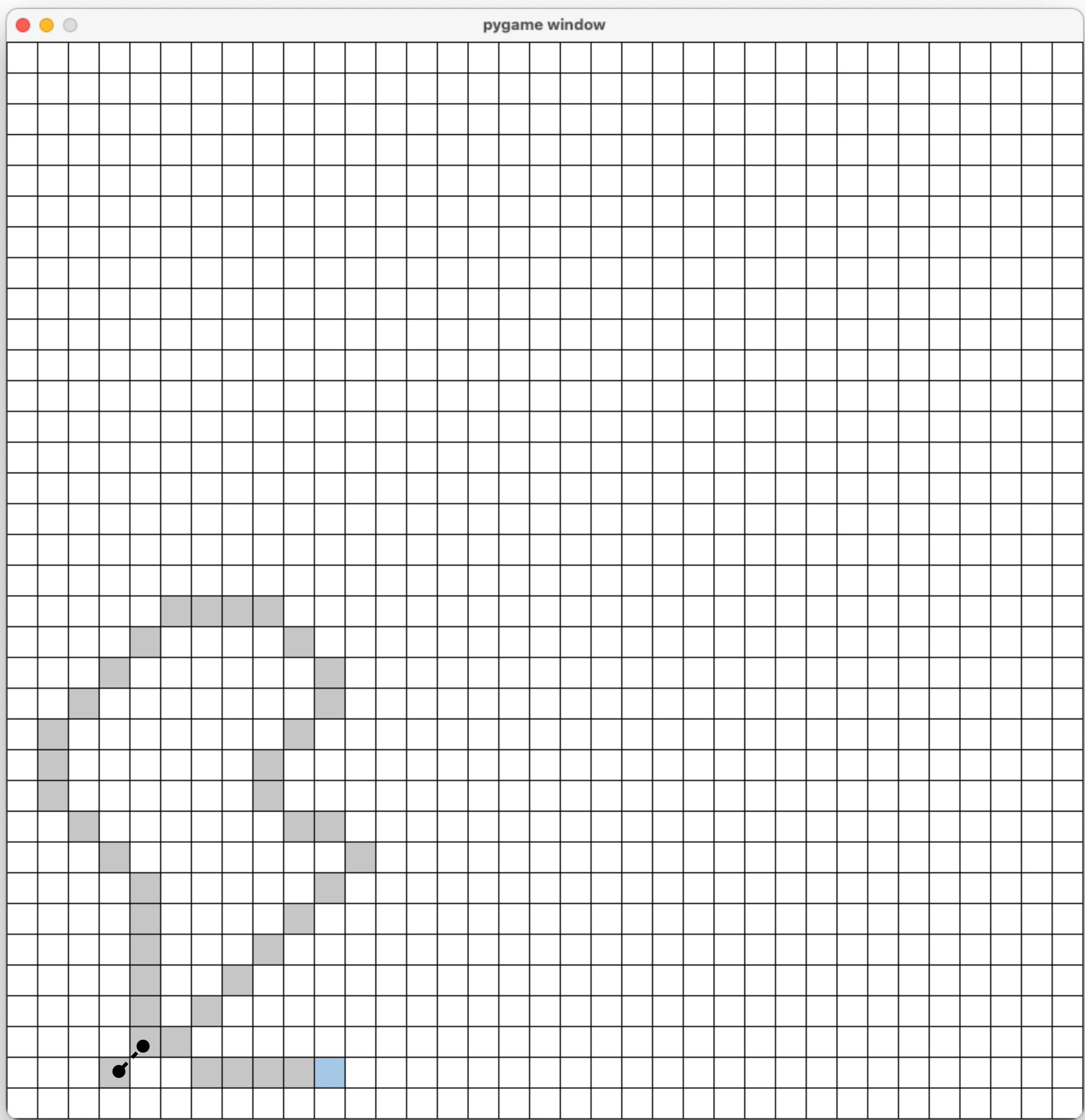
Ce qui équivaut à:
L'ange gagne contre le Gentil Diable
⇒ l'ange gagne contre le Diable

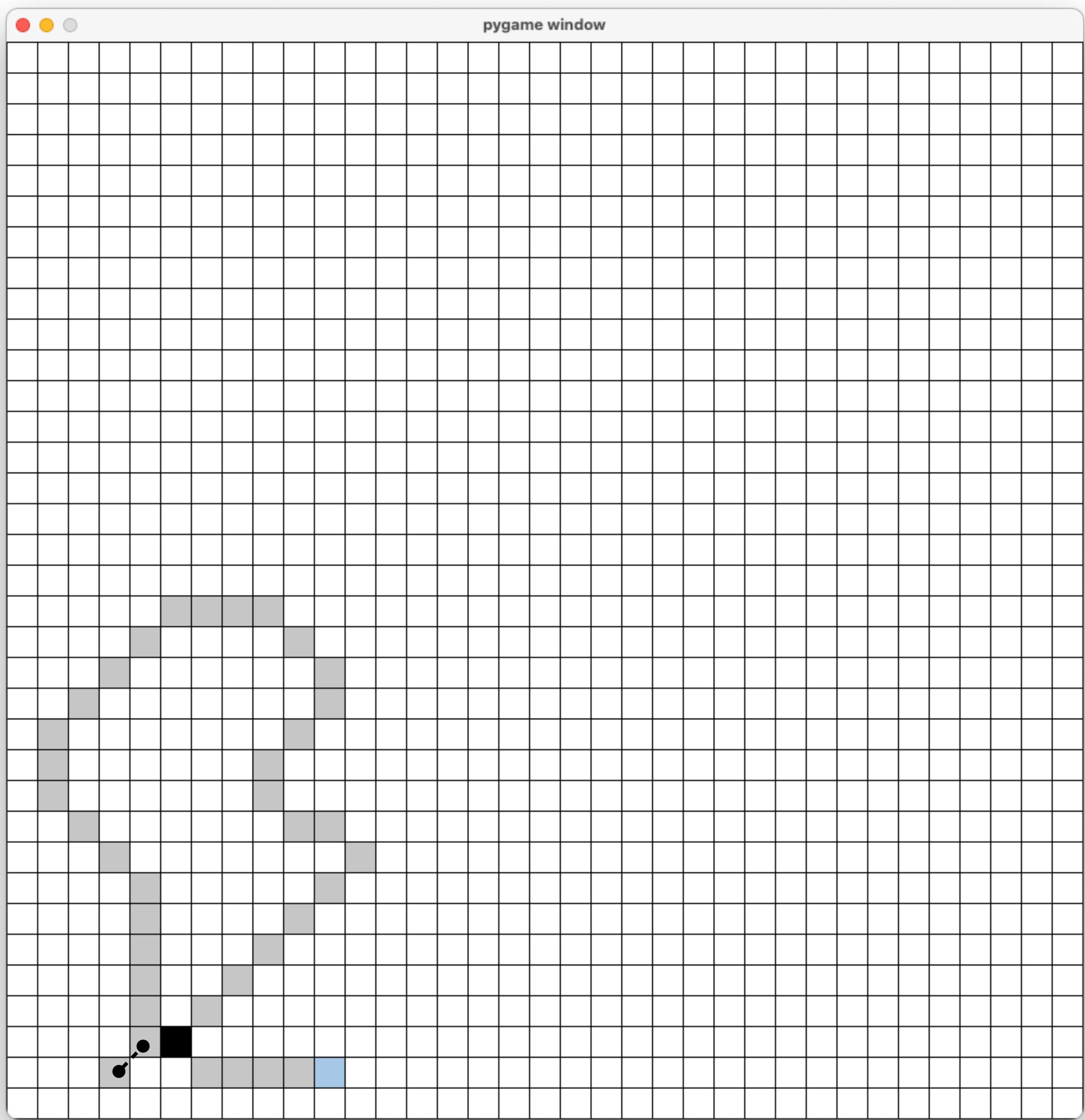
Preuve par contradiction:

Imaginons que l'ange a une stratégie gagnante contre le Gentil Diable, mais qu'il lui est impossible de la jouer contre le Diable.

Le Diable, quand il conseille le Gentil Diable, établit ses coups “contre” le chemin réduit de l’ange. Donc en jouant contre le Diable, l’ange va prendre le chemin réduit.



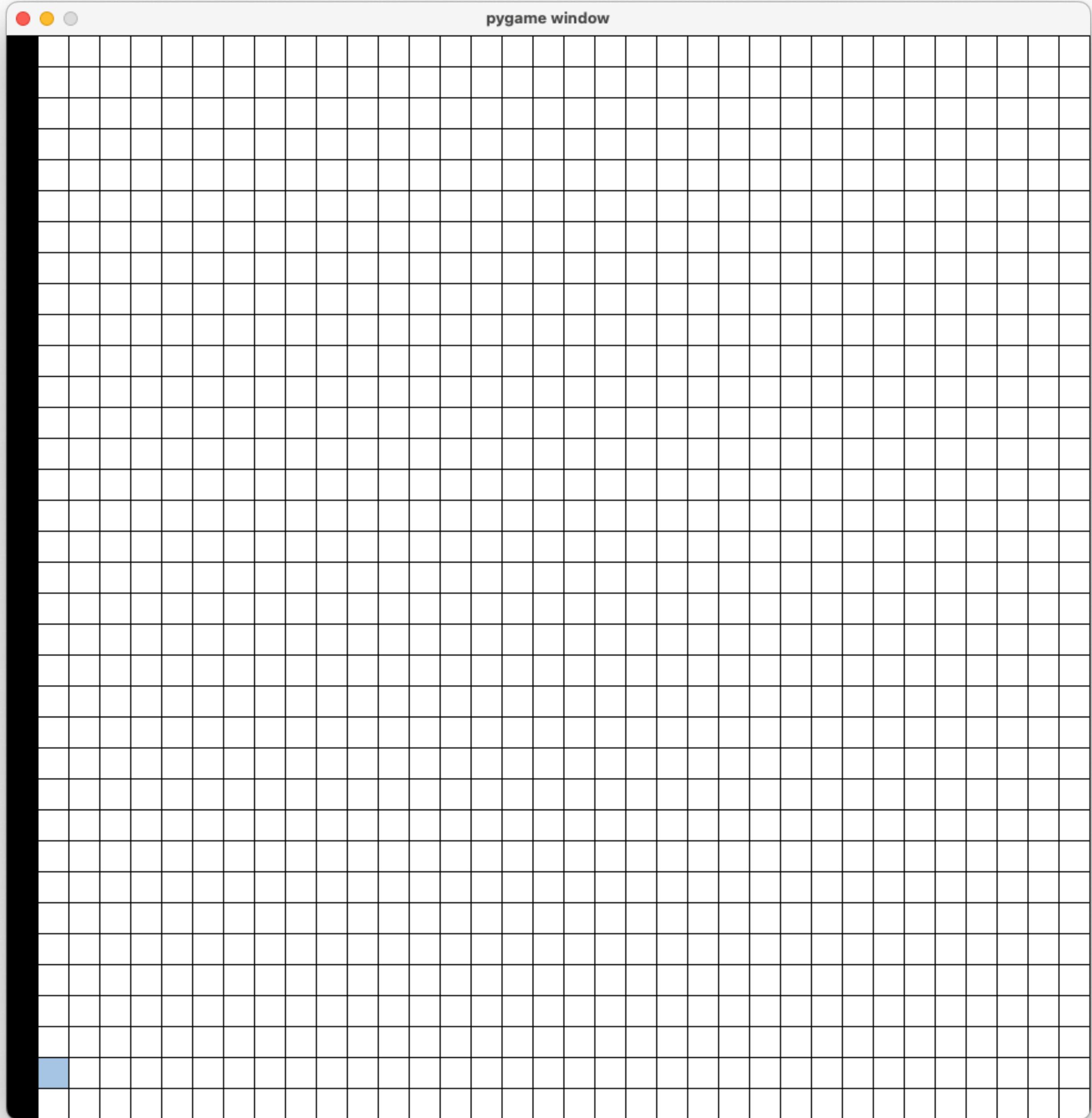


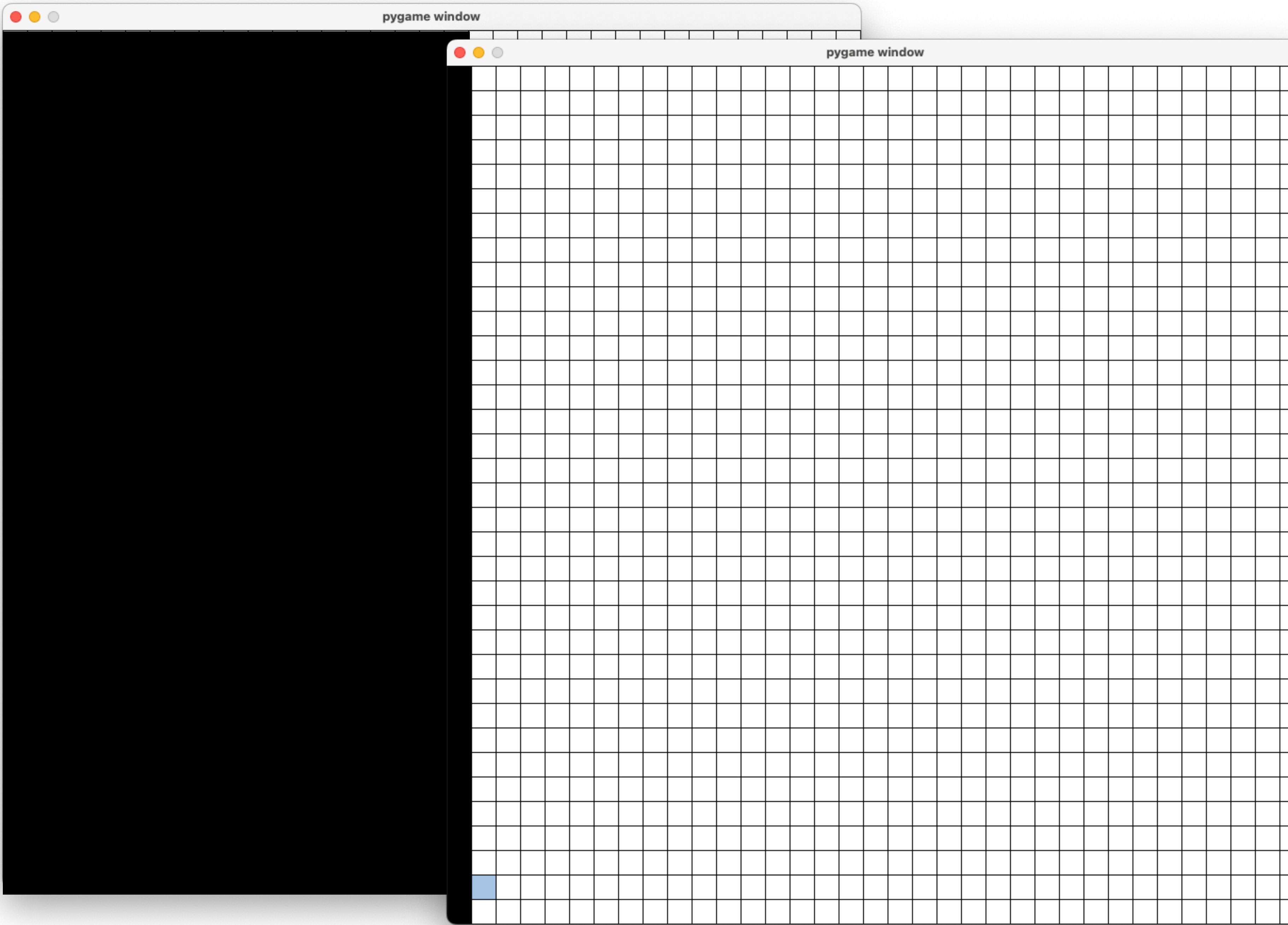


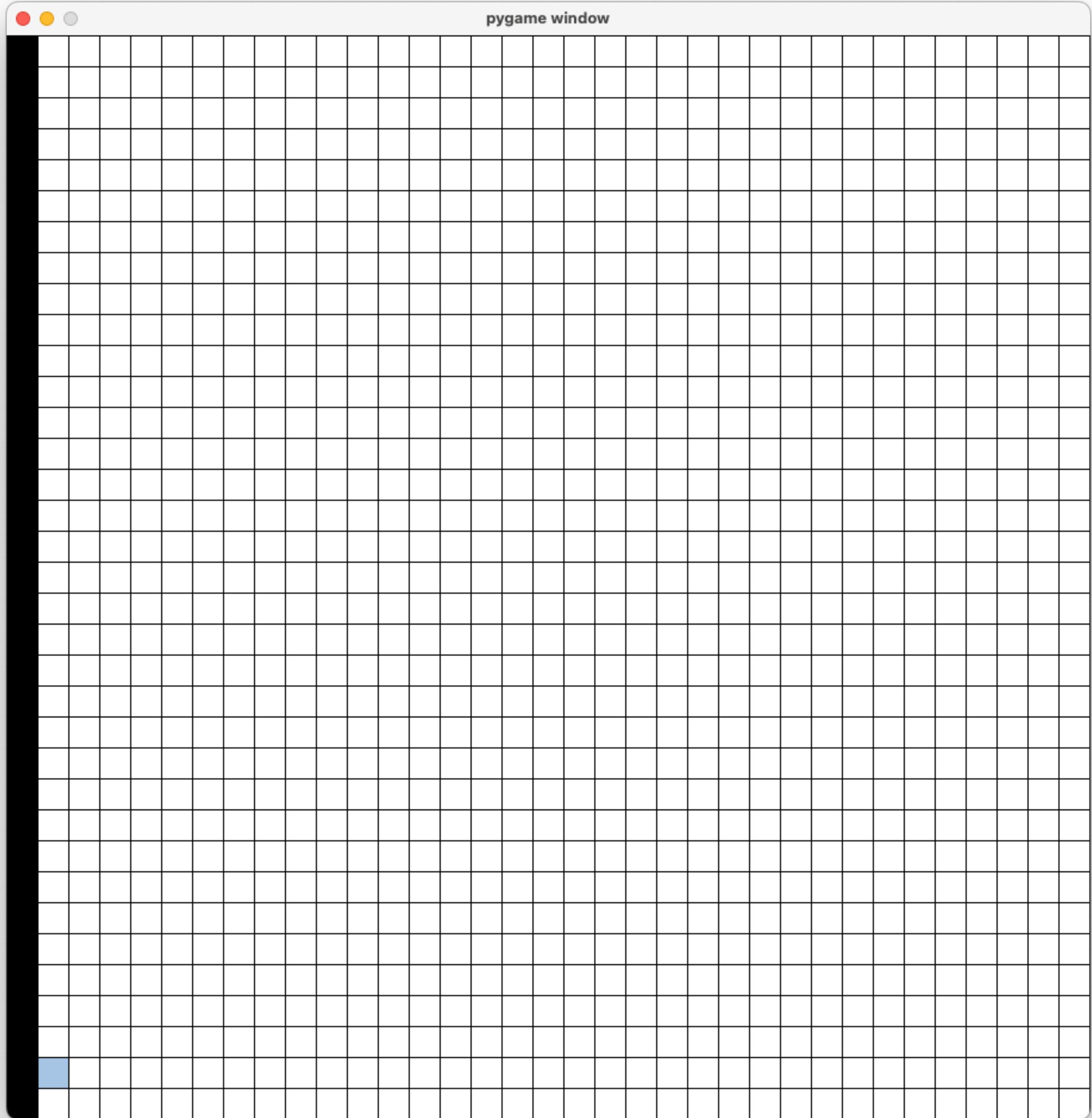
Donc, si l'ange peut jouer un certain chemin contre le Gentil Diable, il peut jouer le chemin réduit équivalent contre le Diable.

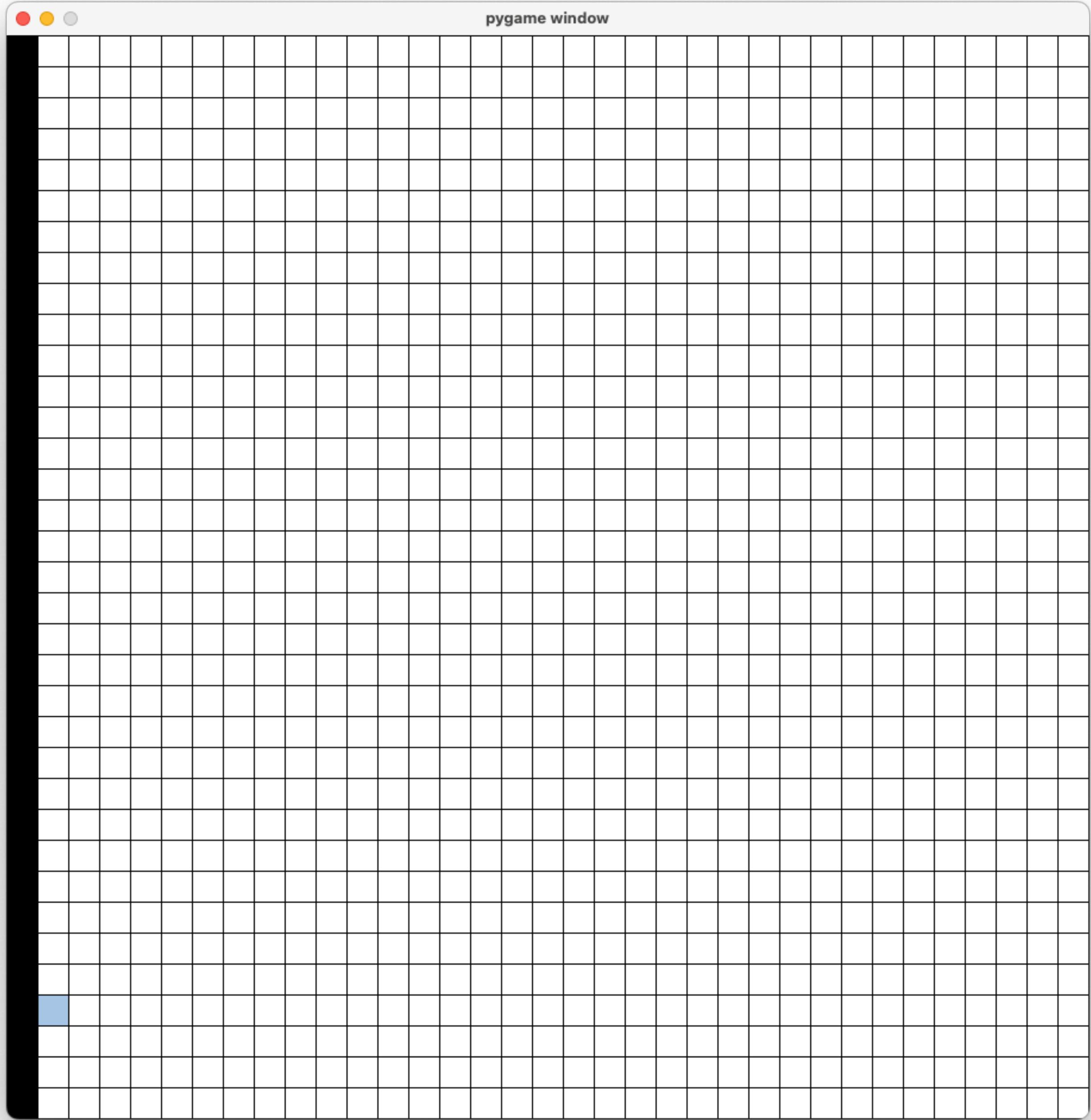
Le Coureur

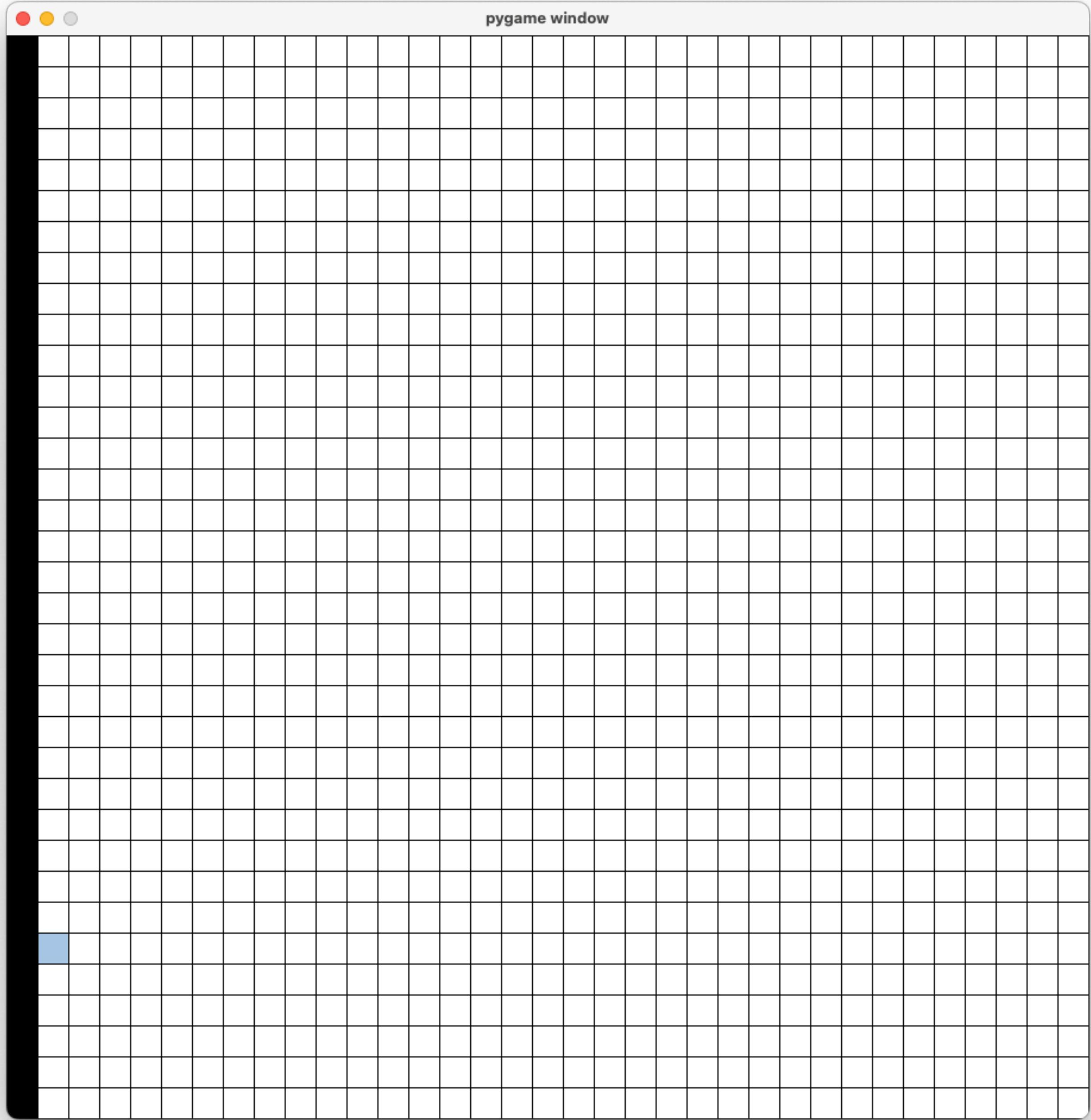


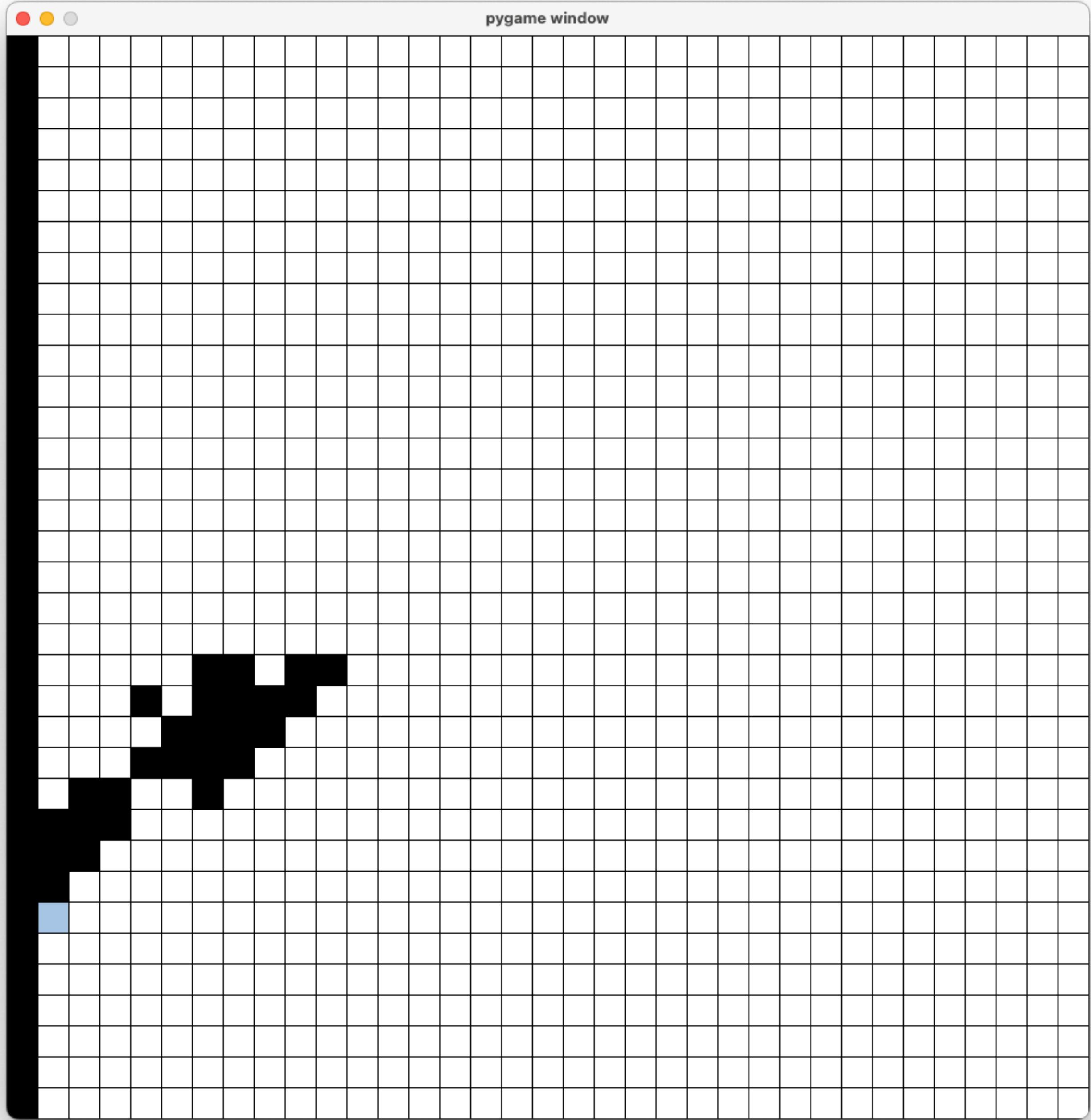


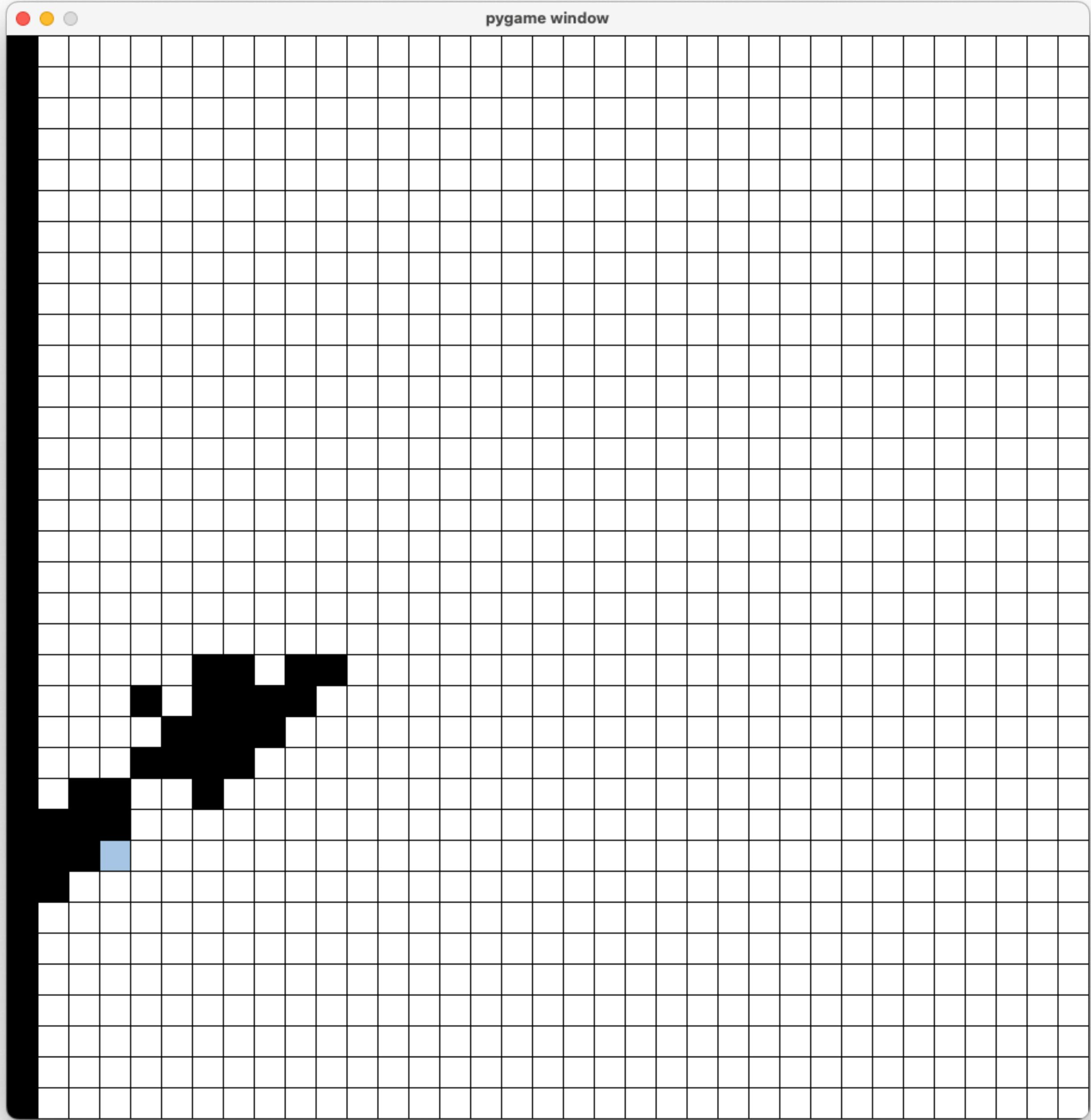


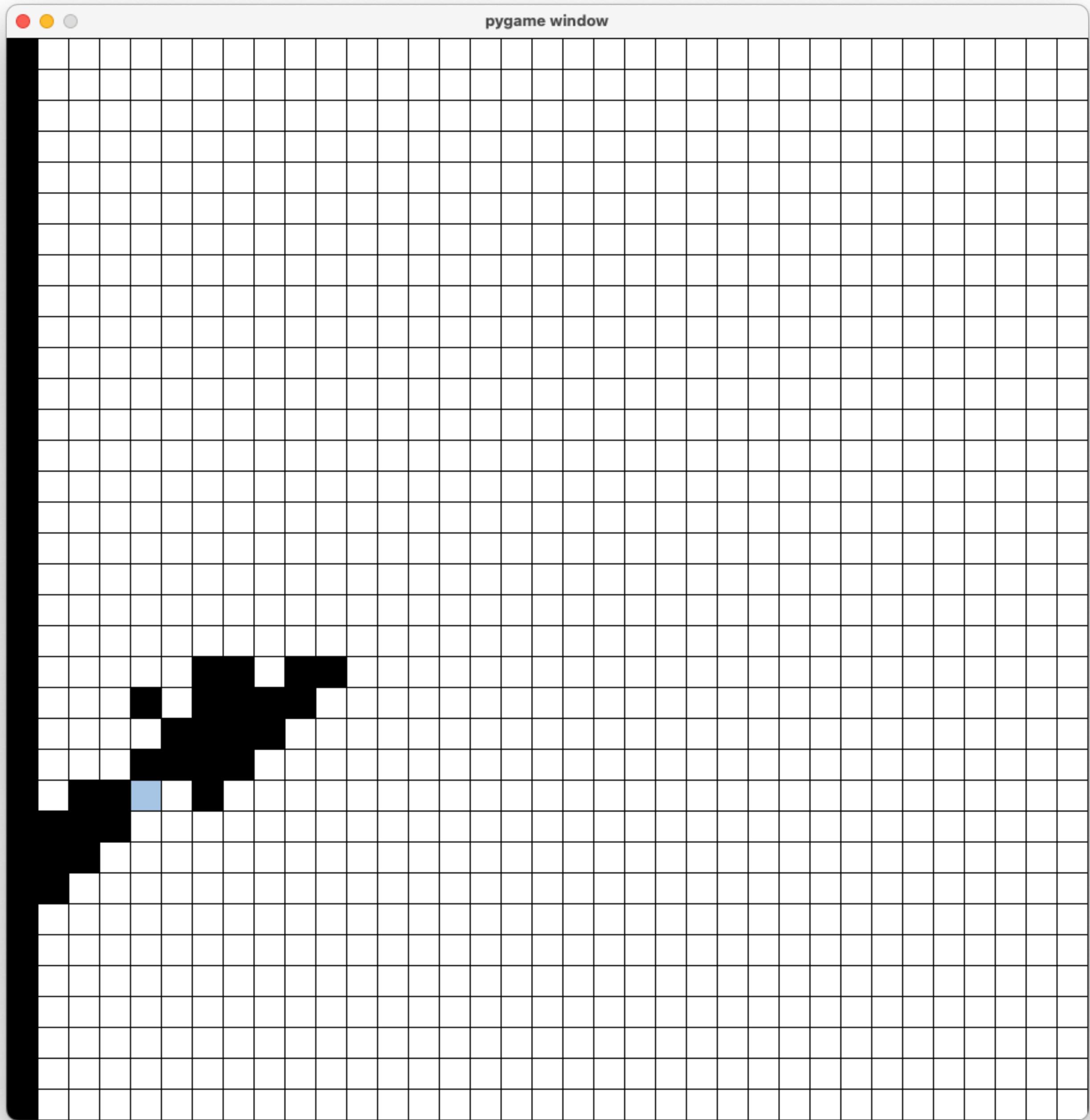


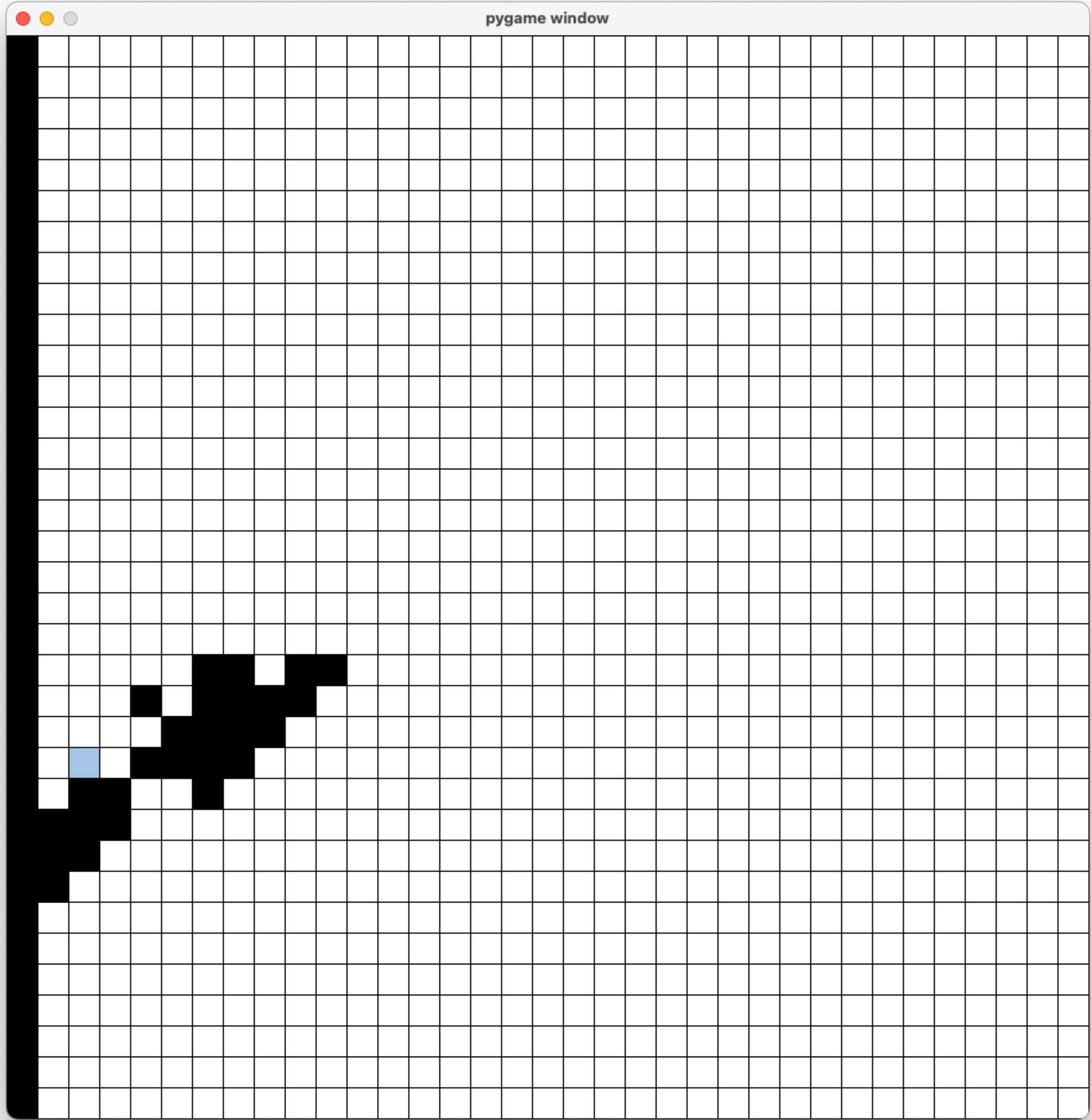


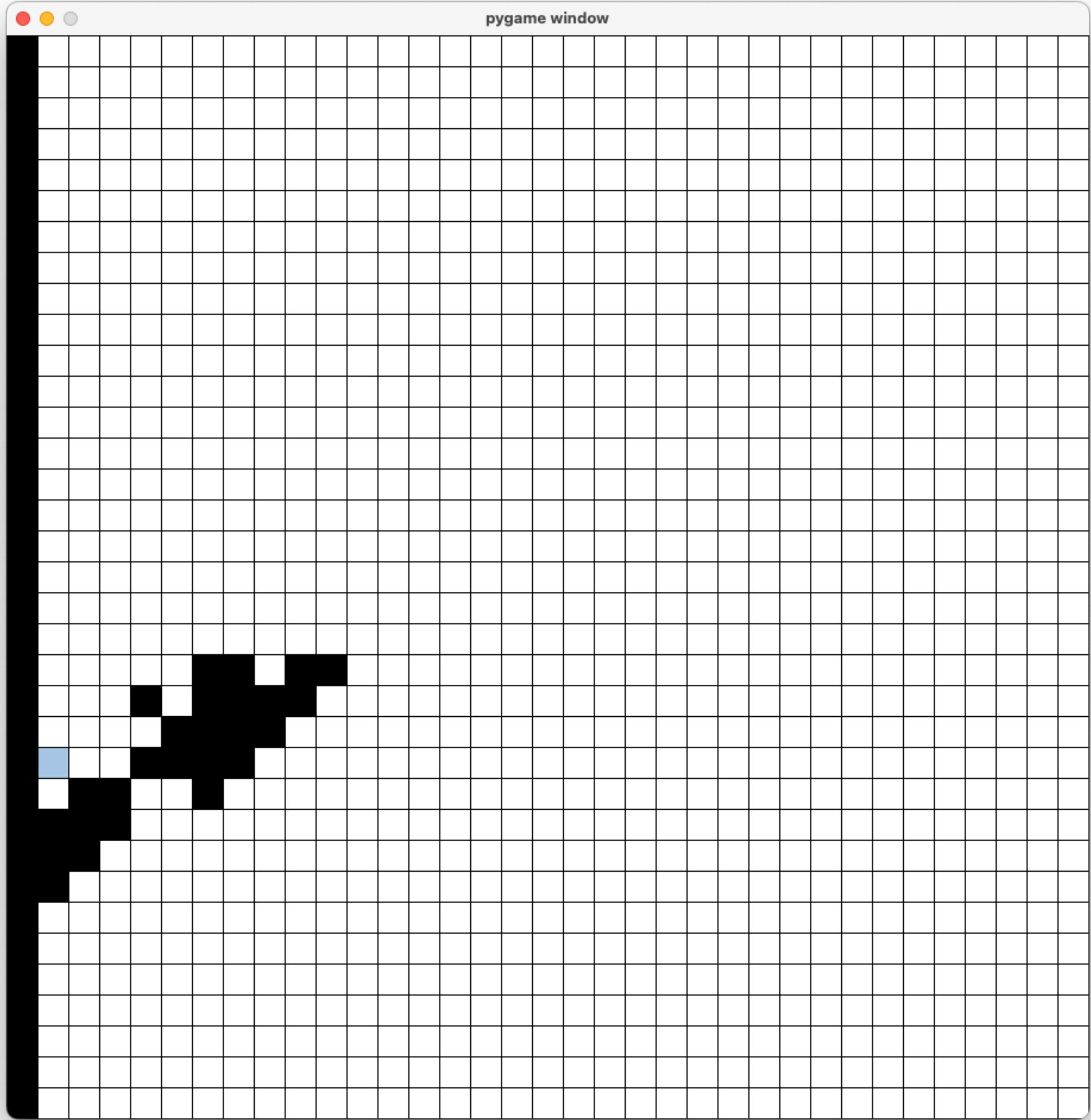


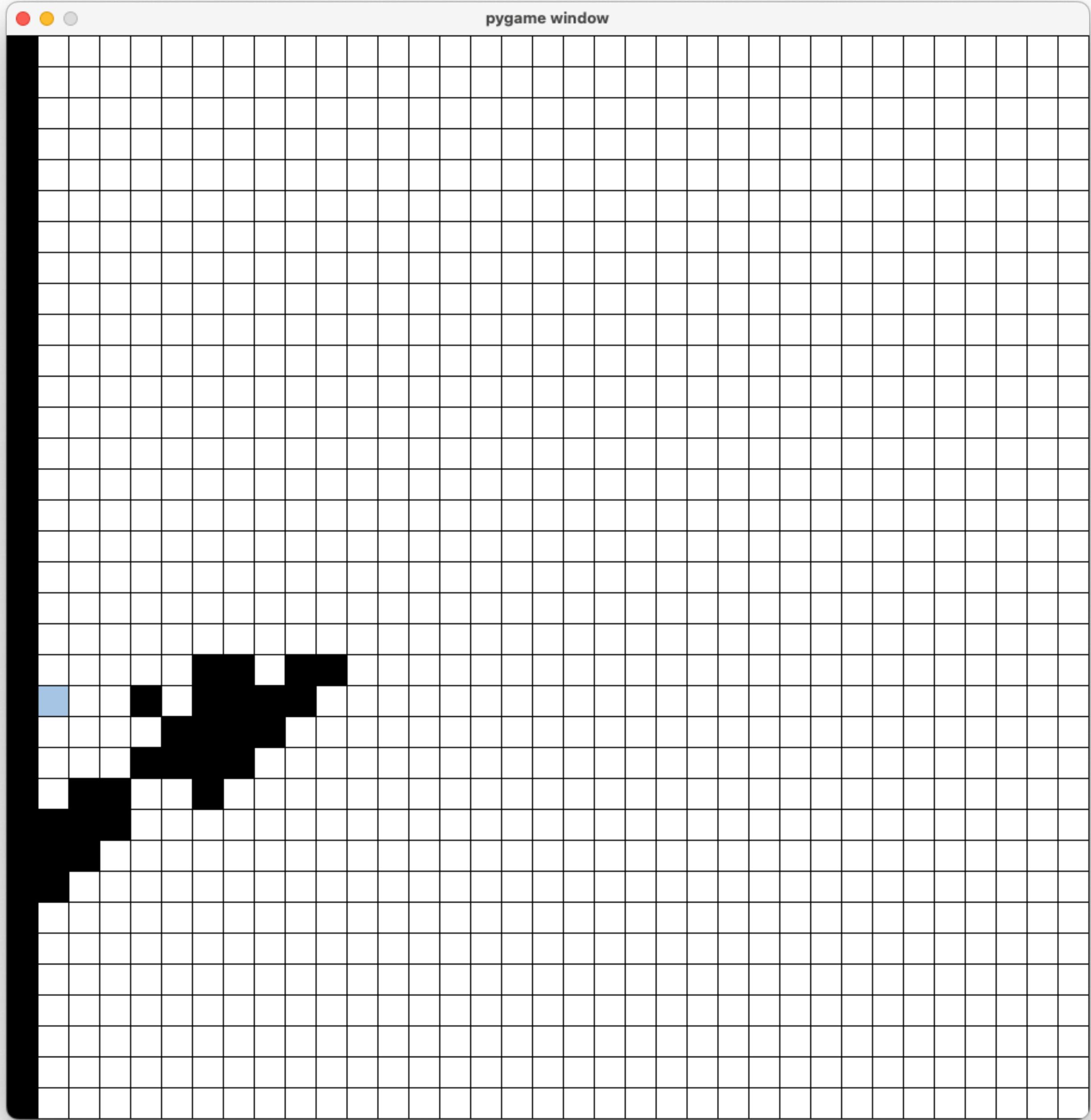






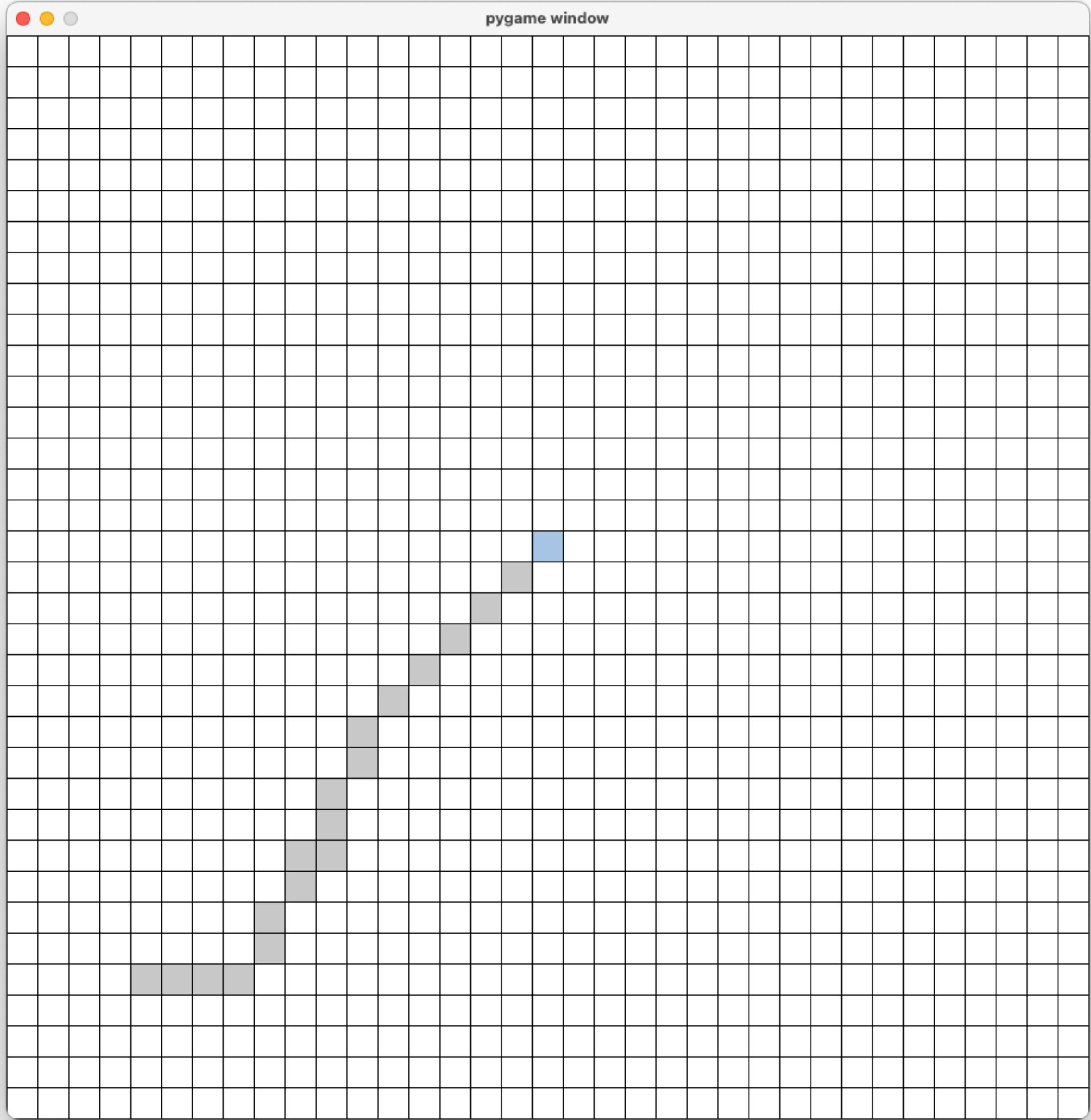


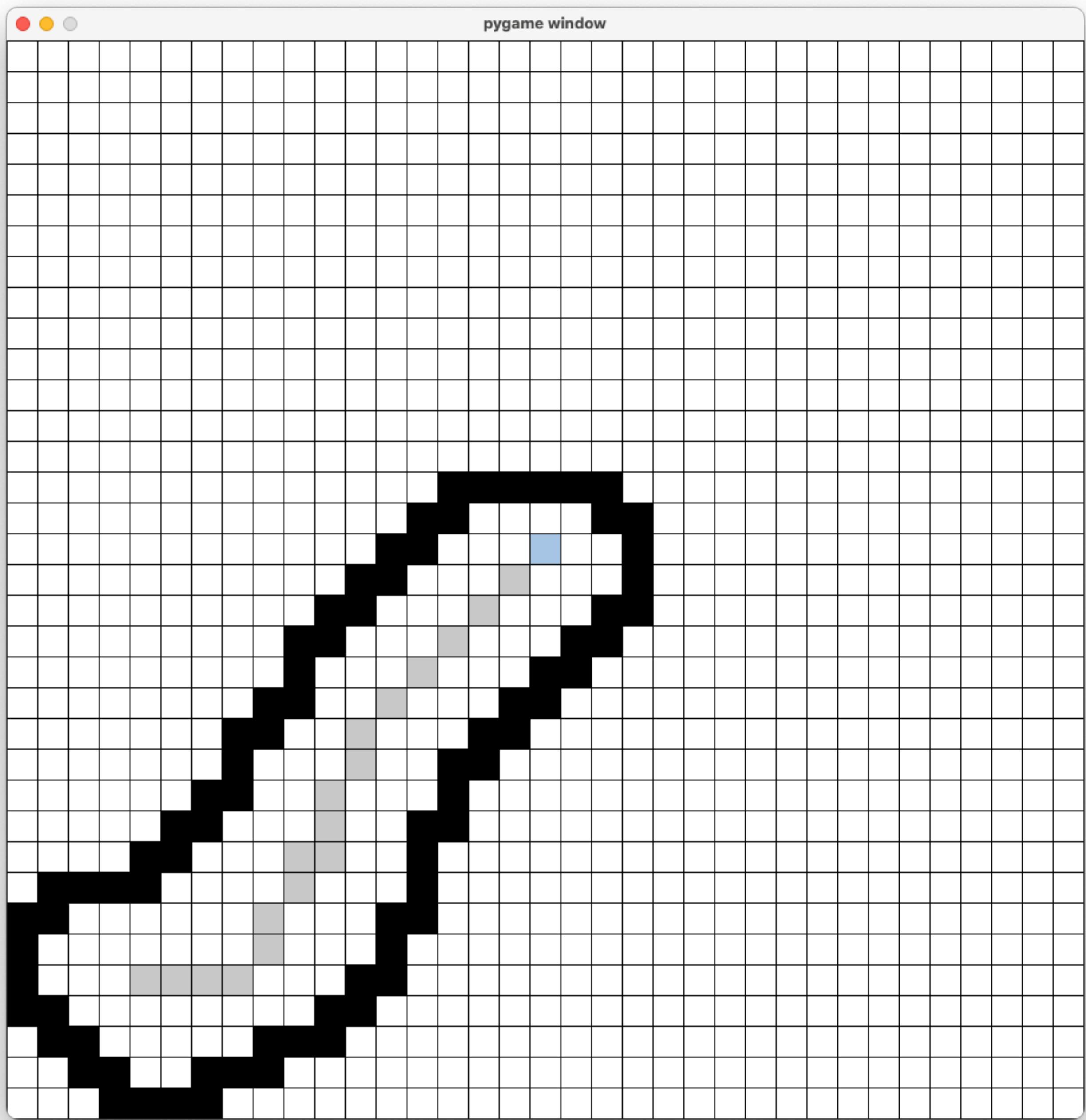


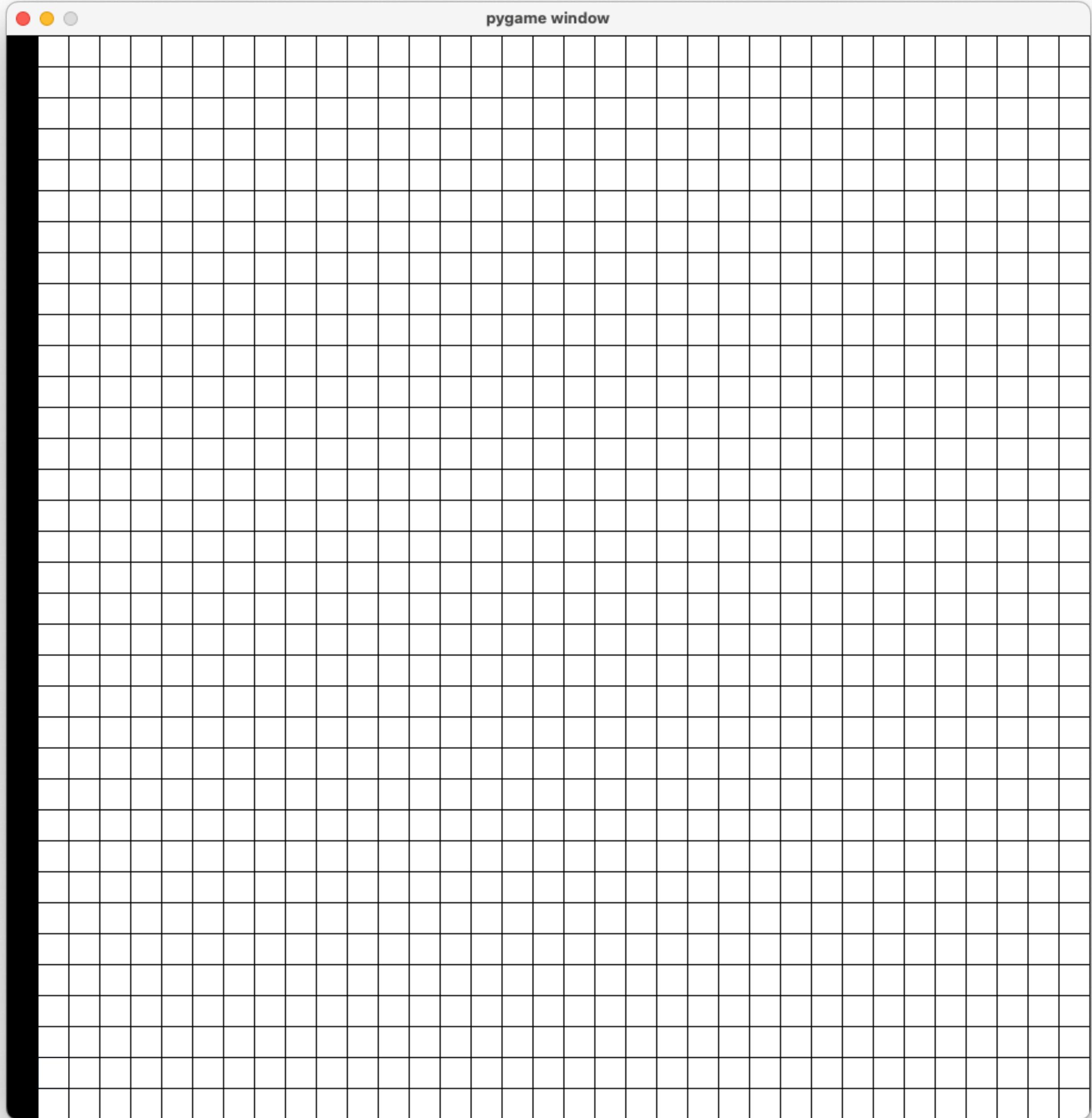


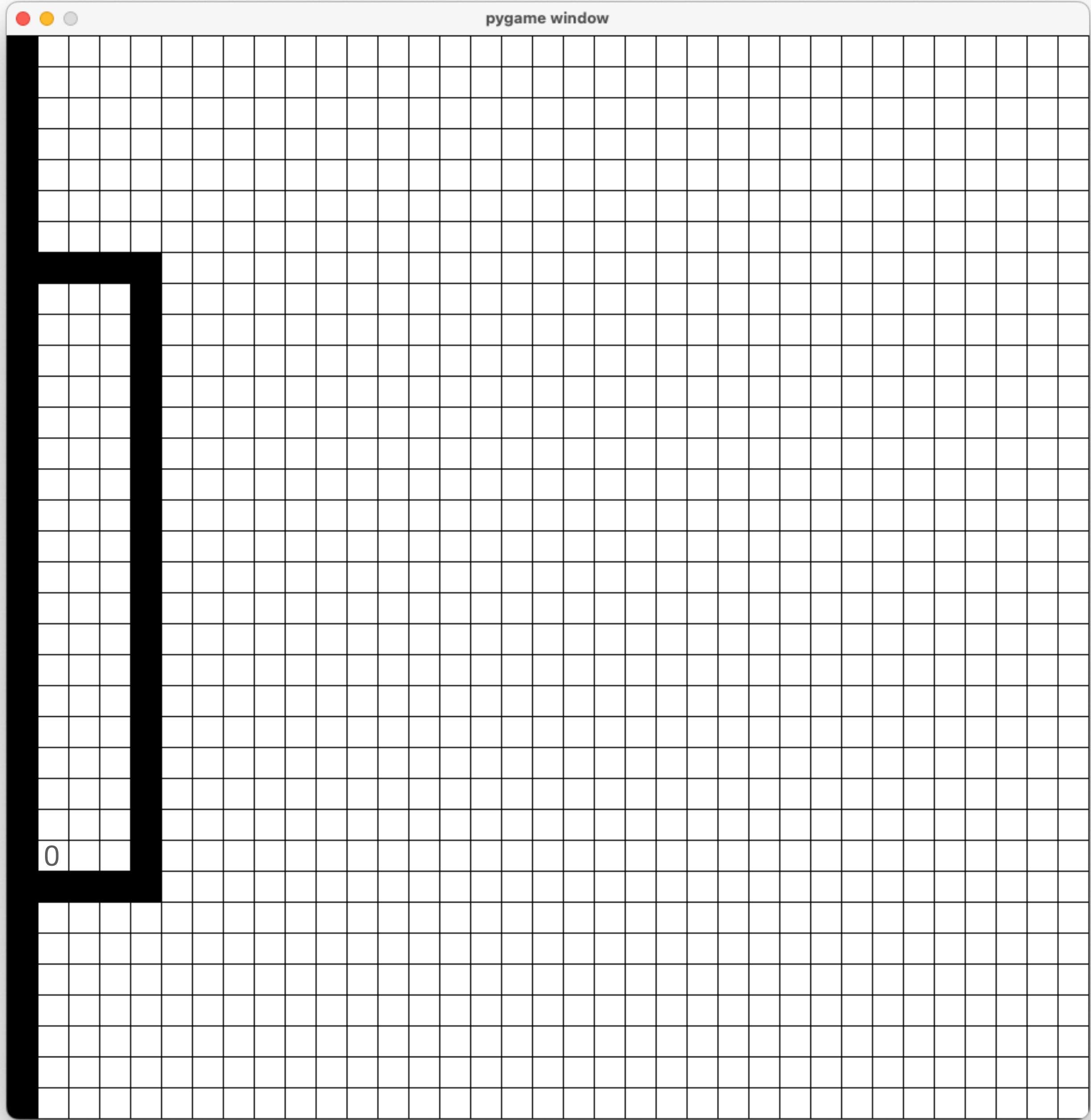
Pourquoi le coureur gagne?

**Le Gentil Diable doit créer un
enclos qui part du mur, et qui
retourne à l'origine**





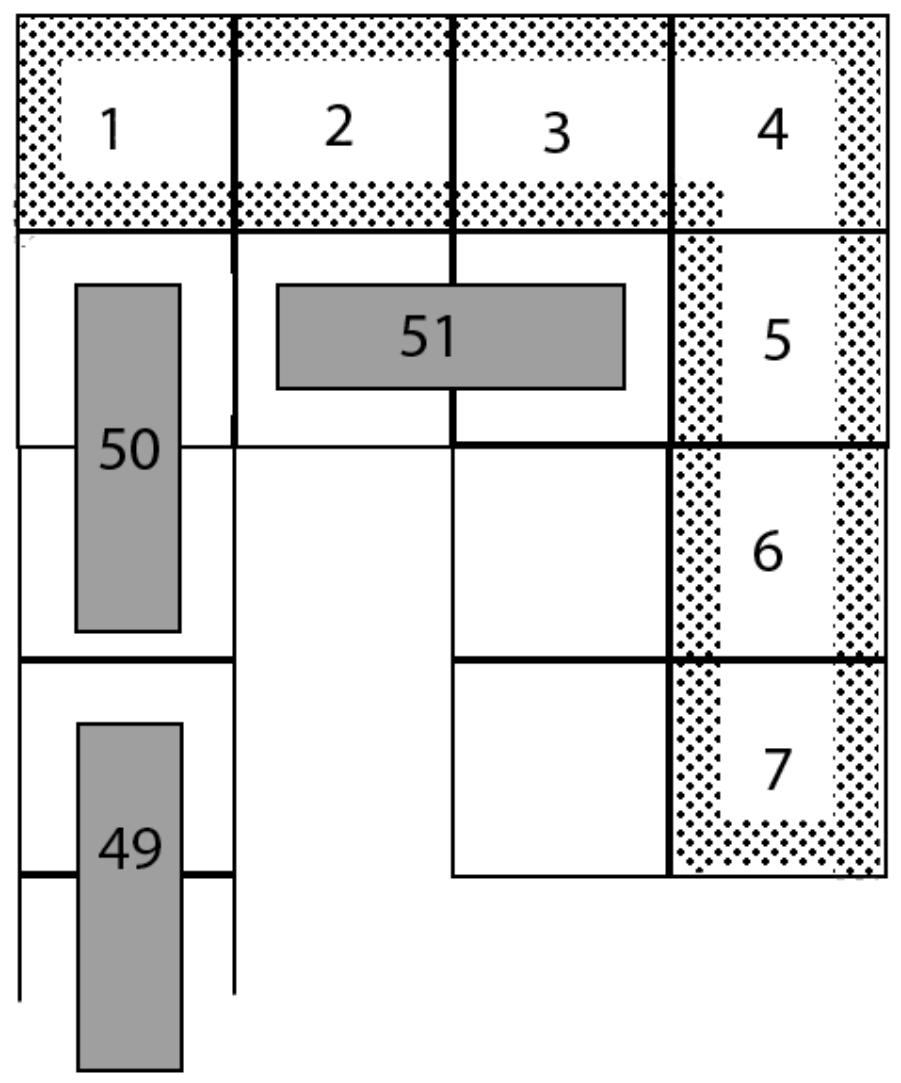




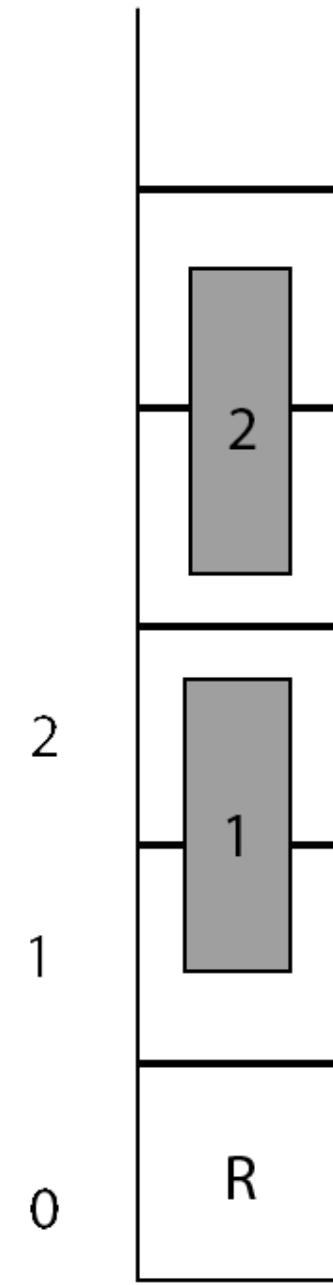
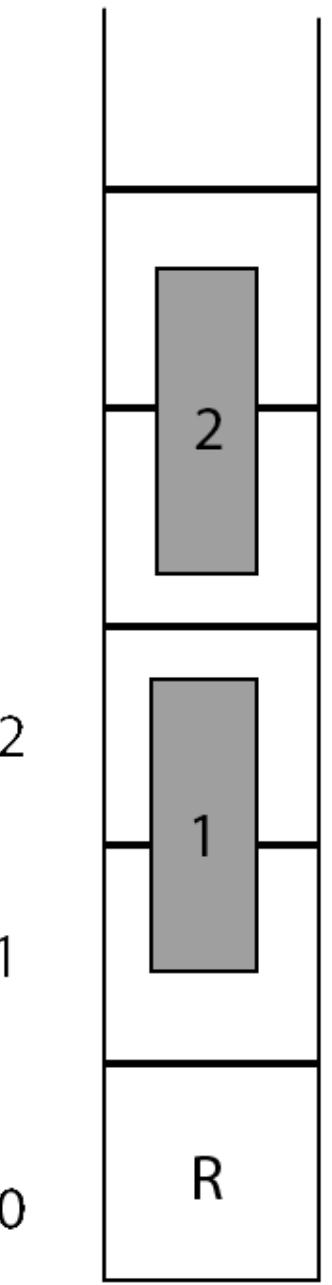
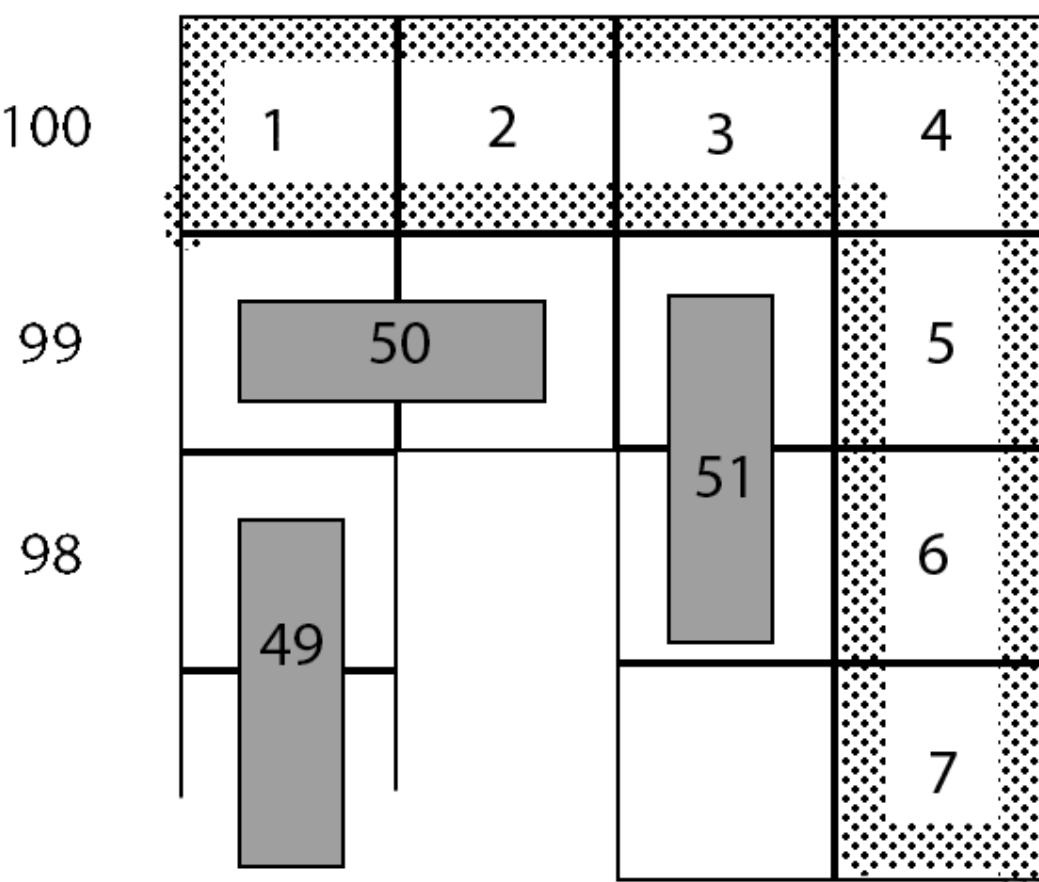
$k = 18$

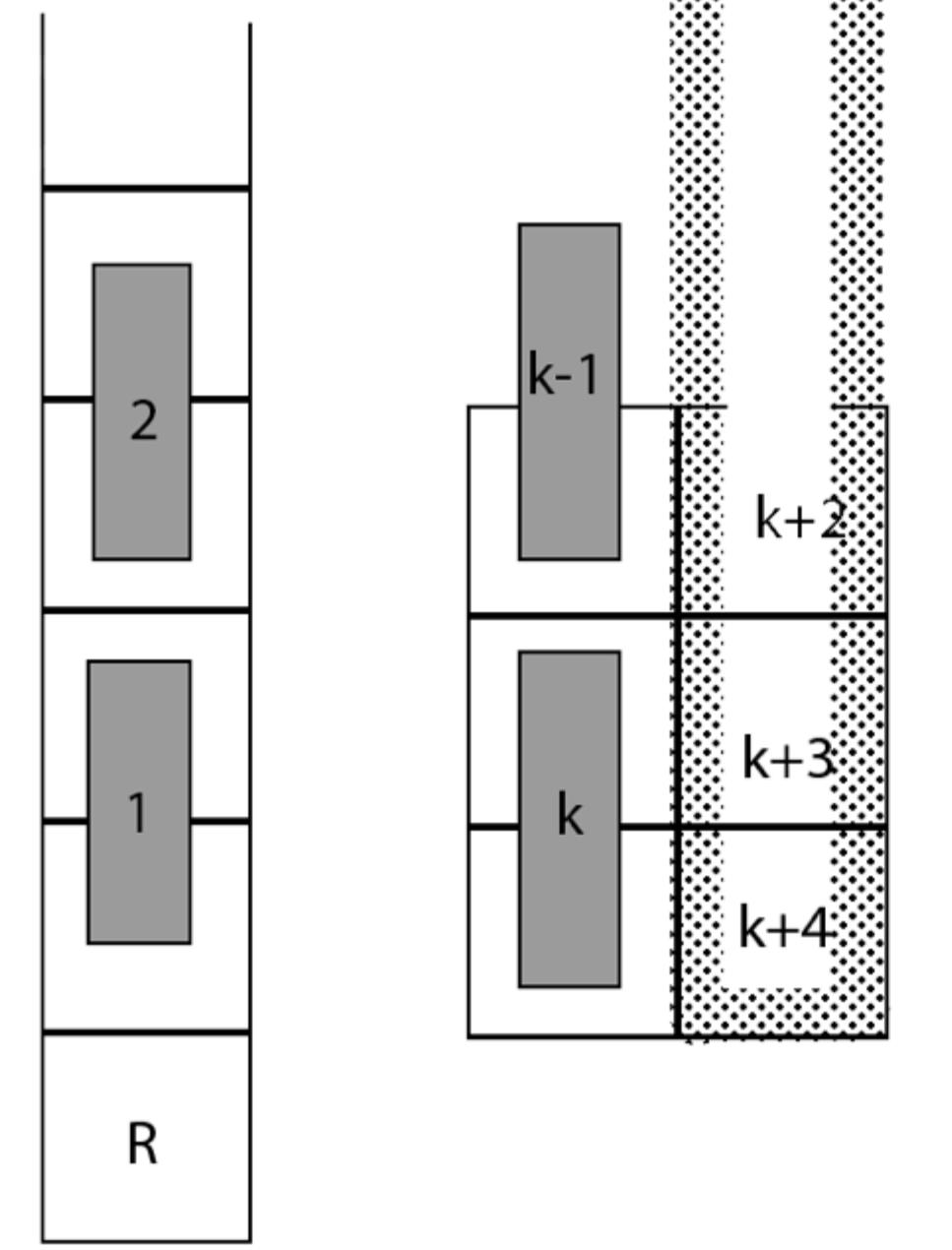
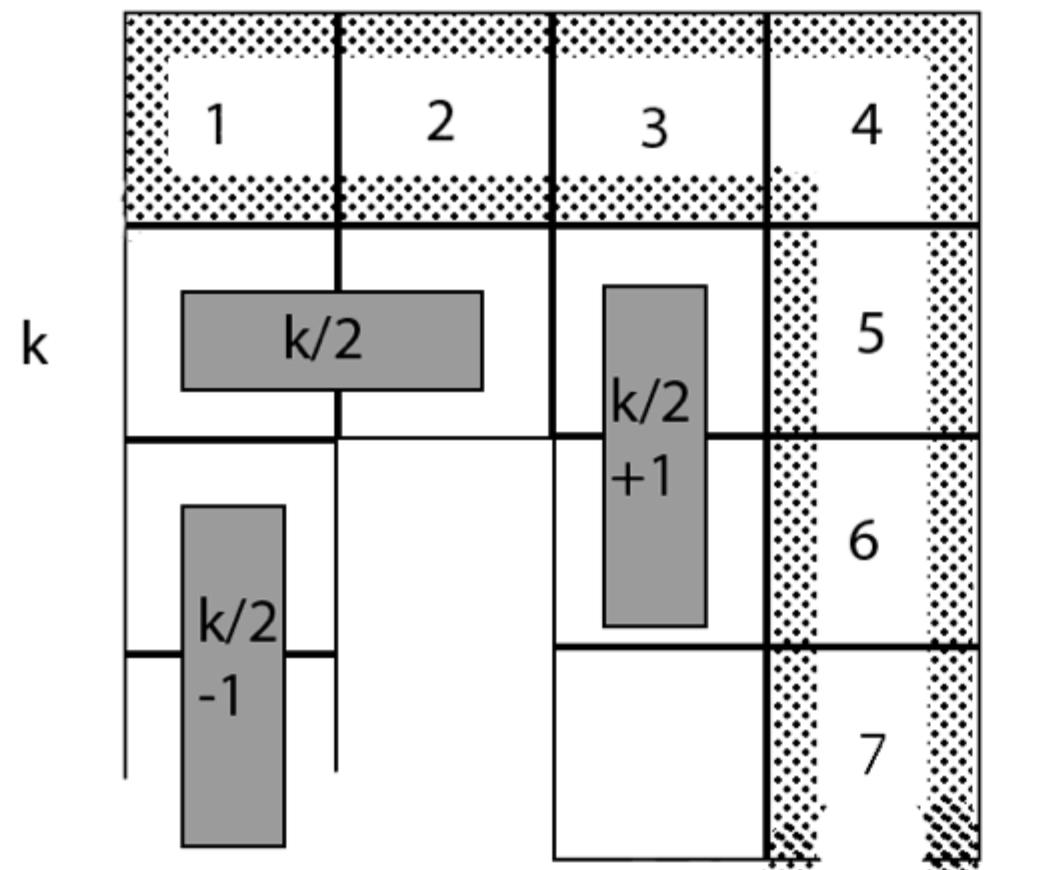
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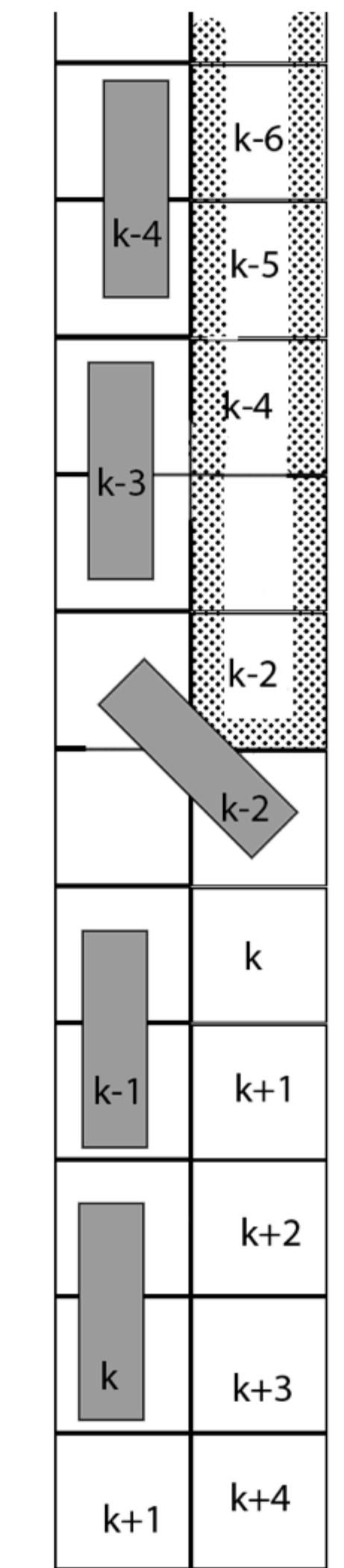
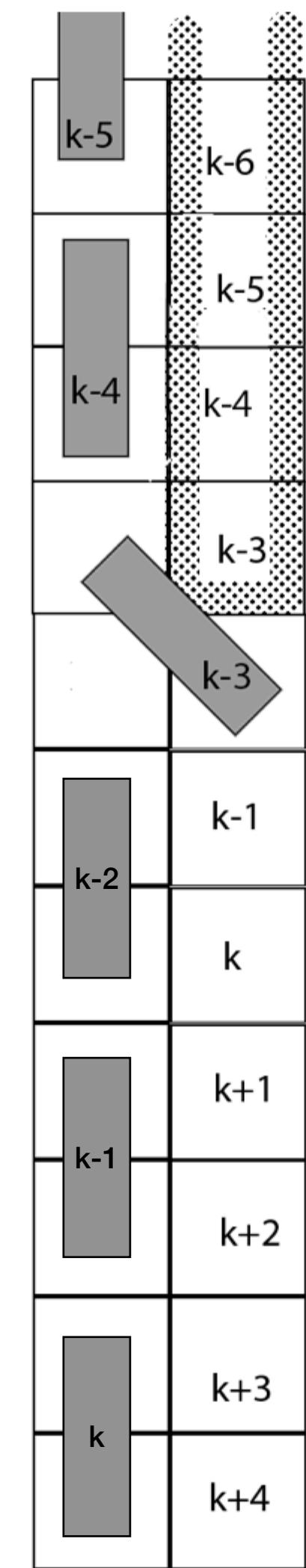
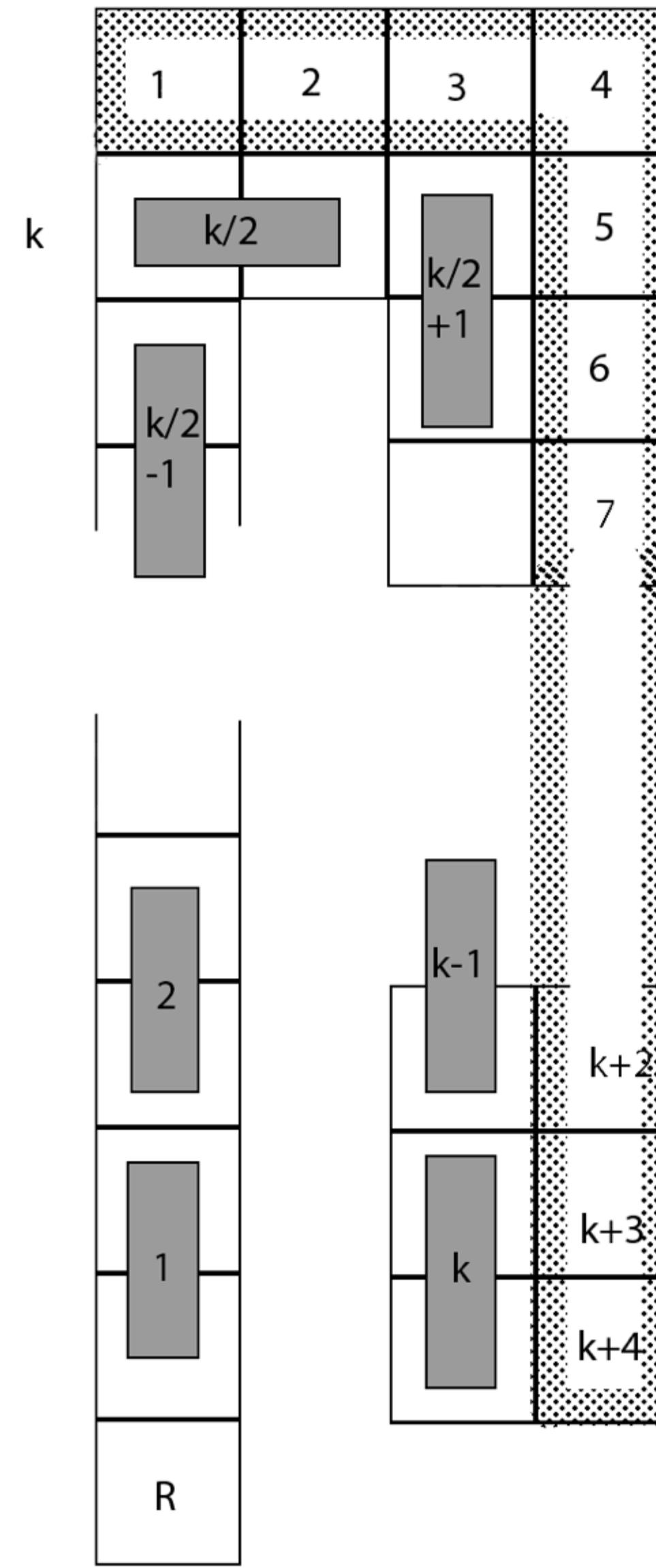
$k = 100$



$k = 99$







k est impair

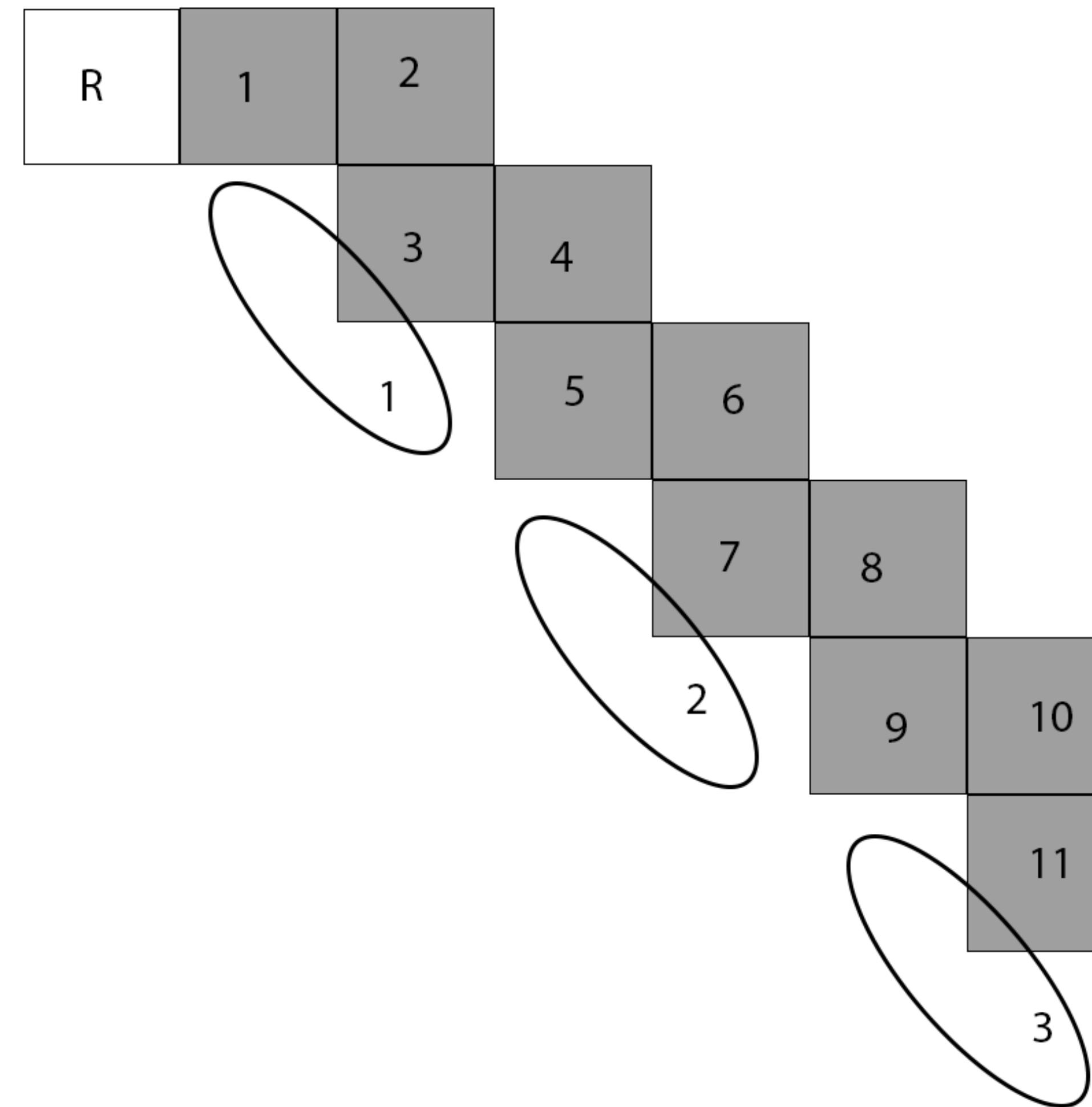
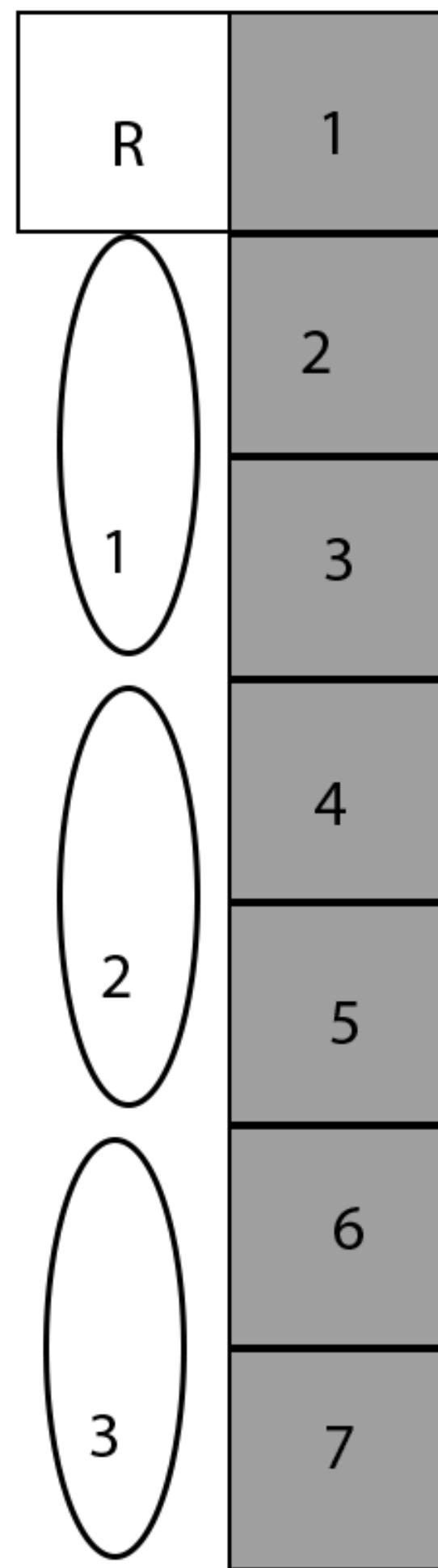
k est pair

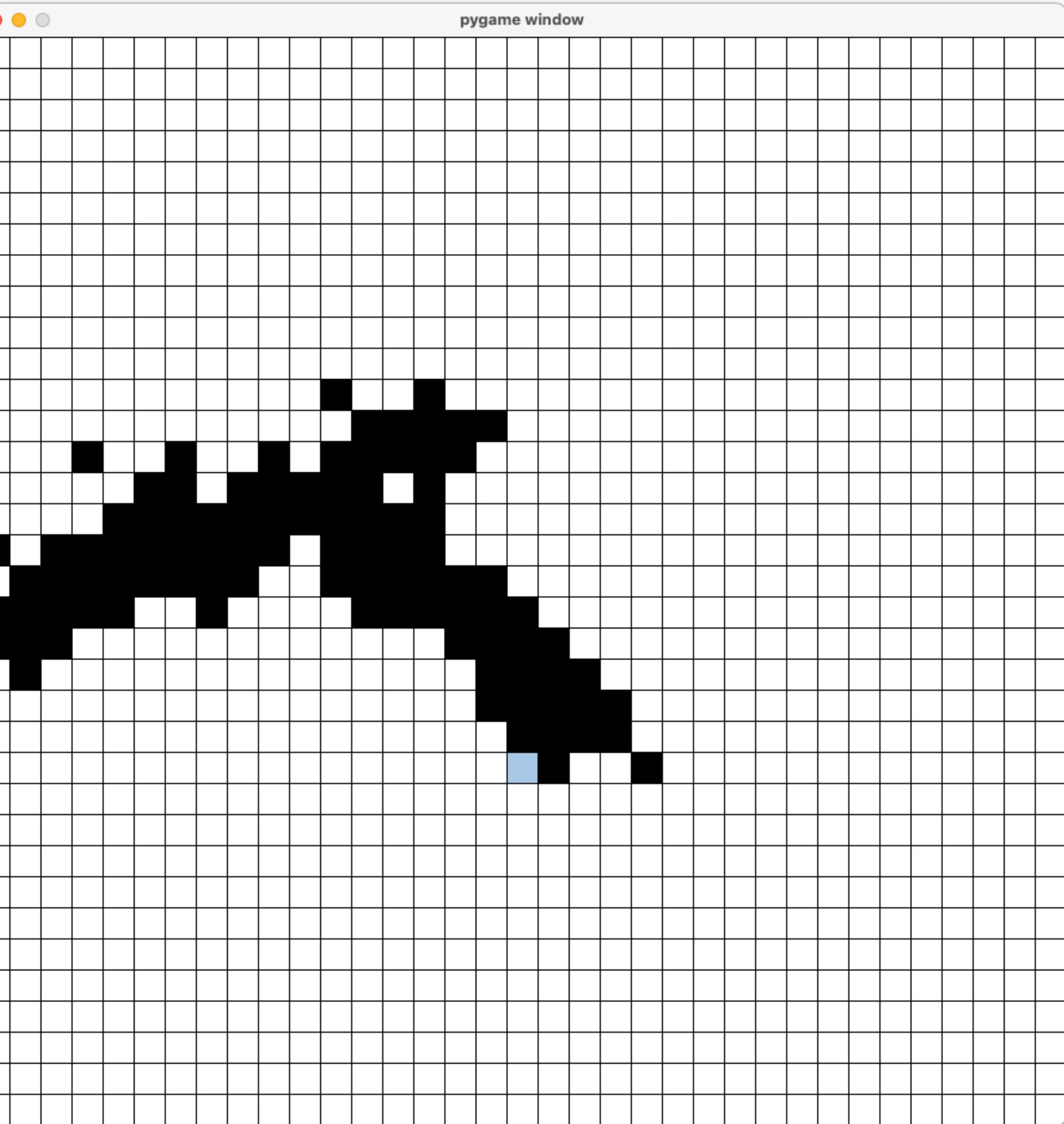
3 cas:

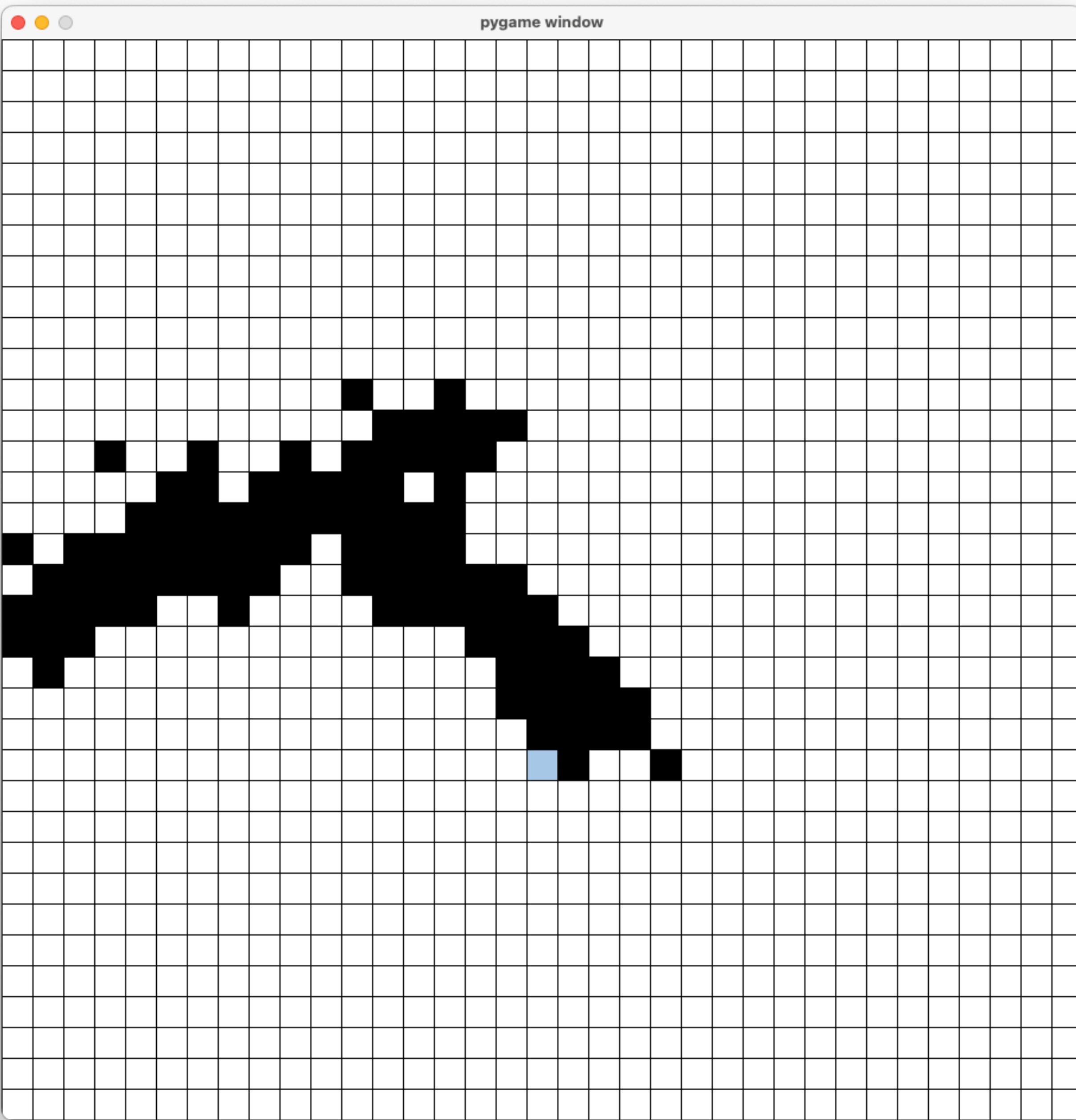
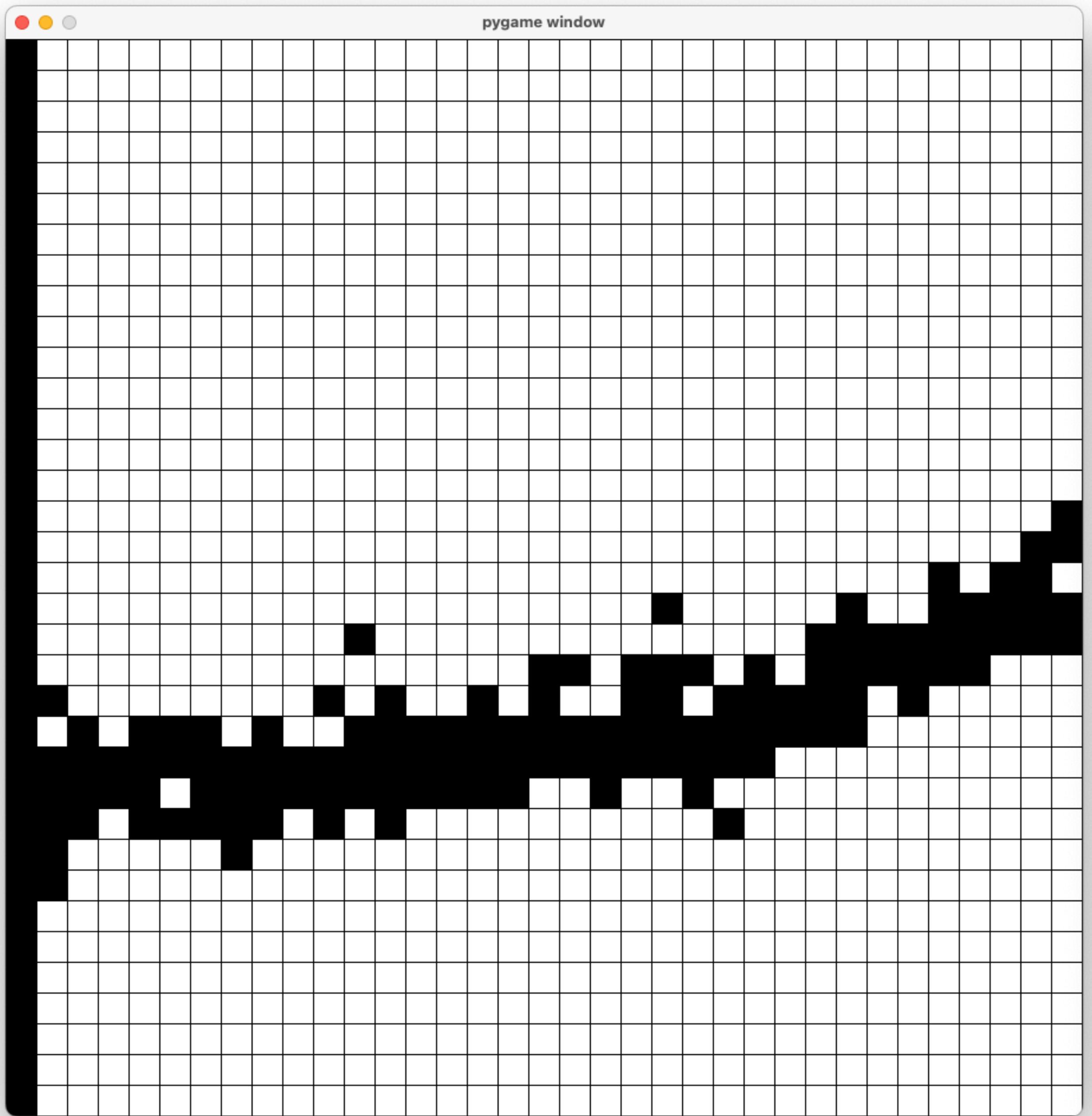
**La partie supérieure de la barrière
est plus longue**

**La partie supérieure de la barrière
est plus courte**

La barrière est en escalier







Qu'avons nous démontré?

1. Si l'ange peut vaincre le Gentil Diable, il peut vaincre le Diable.
2. Pour gagner, le Gentil Diable doit créer un enclos d'une hauteur k jusqu'à l'origine.
3. La création de cet enclos est impossible, donc l'ange vainc le Gentil Diable.

**Donc, l'ange de puissance 2
peut vaincre le Diable.**

Mais... comment?

Questions?