

# COMP 6660 Fall 2025 Assignment 2a

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## 1 Results

### 1.1 Green

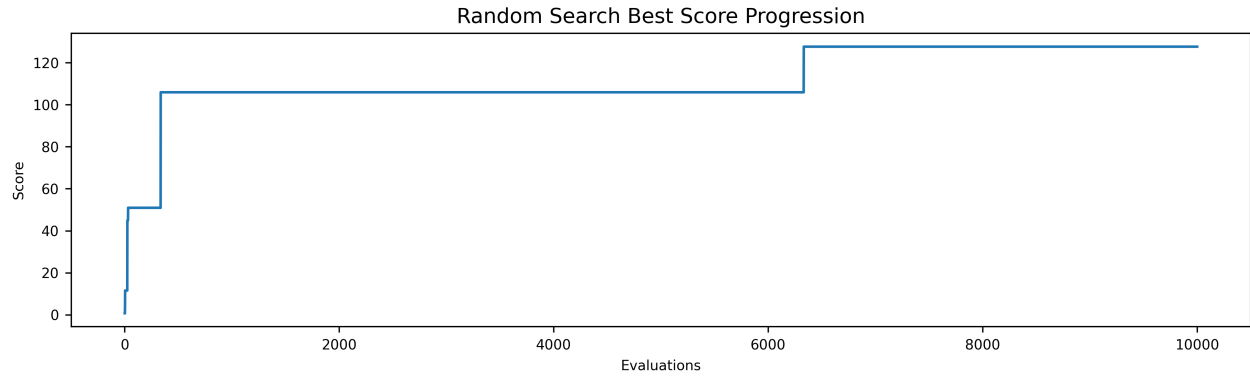


Figure 1: Enter Caption

Table 1 summarizes the best score observed in each of the ten random-search runs. The experiment achieved a mean best score of 112.721 with a sample standard deviation of 11.655. Run 6 found the strongest controller with a score of 127.674.

Run	Best Score
1	102.946
2	112.713
3	105.891
4	109.147
5	92.016
6	127.674
7	106.744
8	123.798
9	118.686
10	127.597

Table 1: Best scores per run for the random-search experiment. Values sourced from `data/2a/green/best_per_run.txt`.

Figure 2 provides a placeholder for the stair-step plot of evaluations versus the incumbent best score for the highest-scoring run. Insert the exported PNG from `data/2a/green/stairstep.png` in place of the placeholder before submission. Figure 3 likewise reserves space for the histogram of best scores across all runs using `data/2a/green/histogram.png`.

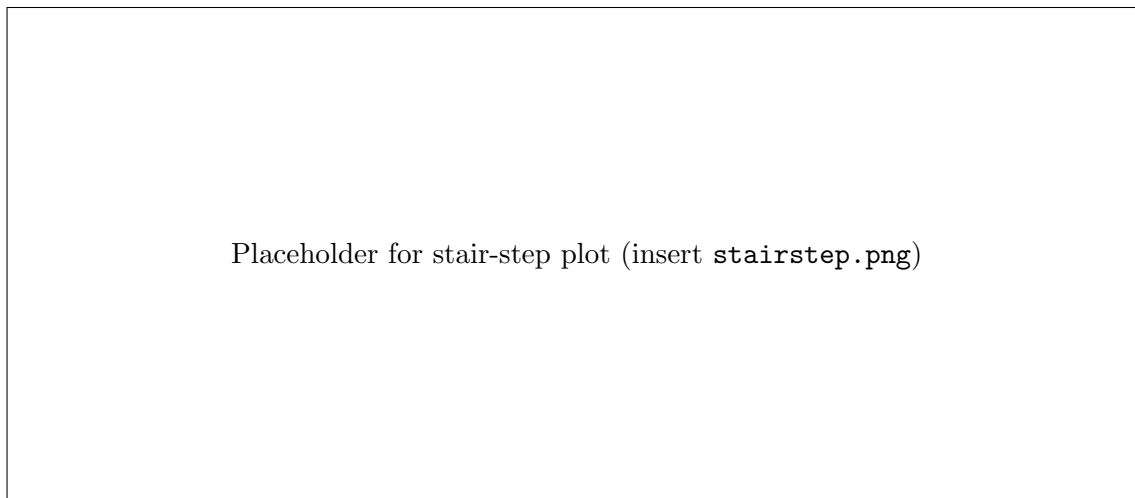


Figure 2: Evaluations versus best score progression for the strongest random-search run.

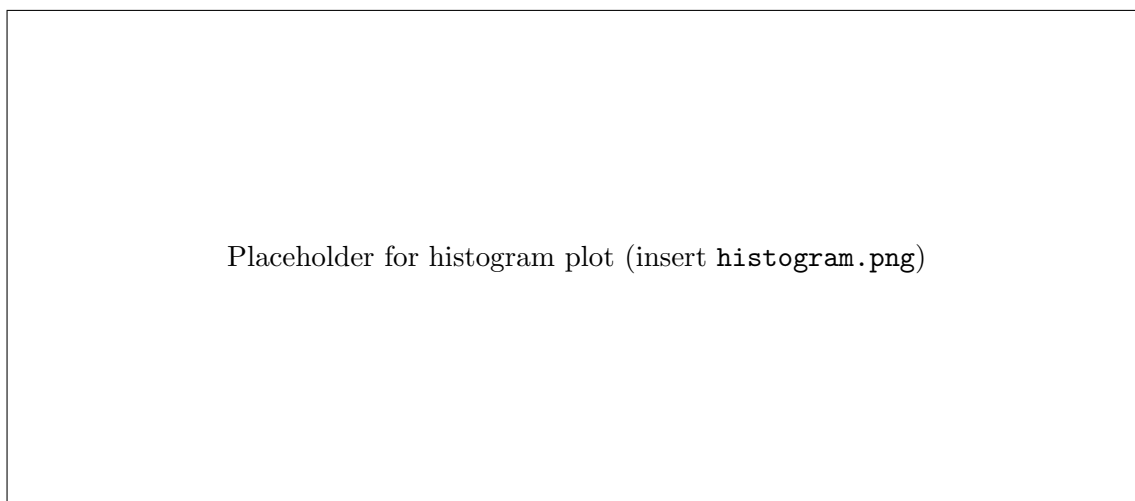


Figure 3: Histogram of best scores across ten random-search runs.

## 1.2 Informal Behavioral Analysis

The assignment requires an informal description of the evolved controller's behavior after reviewing the visualization of the top-scoring run. Access to an interactive browser is needed to play the animation contained in `data/2a/green/visualization.html`. Because the current environment does not support rendering the interactive visualization, the behavioral write-up remains outstanding. Please revisit this section after observing the animation and summarize notable strengths, weaknesses, and quirks exhibited by the controller.

### 1.3 Hill Climber Investigation (Red 2 Bonus)

The hill climber consistently outperformed random search on this workload. Table 2 lists the per-run best scores, which averaged 142.047 with a standard deviation of 8.040. The weakest hill-climber run (Run 4) still surpassed the random-search mean.

Run	Best Score
1	141.473
2	138.450
3	158.450
4	132.093
5	133.643
6	139.922
7	149.147
8	137.442
9	140.620
10	149.225

Table 2: Best scores per run for the hill-climber baseline, derived from `data/2a/hill_climber/best_per_run.txt`.

A two-sample  $t$ -test contrasting the two sets of best scores yields a statistic of  $t \approx -6.55$  with  $p < 10^{-4}$ , indicating that the hill climber’s superior mean is statistically significant under standard assumptions of independent runs with unequal variances.

### 1.4 Ghost Controller Random Search (Red 1 Bonus)

The ghost random-search experiment ran under the modified primitive set and evaluation function discussed above. Across all ten runs, the best controller achieved a Pac-Man score of 0.775, indicating that the ghost repeatedly caught Pac-Man almost immediately. Because every run converged to the same score, the distribution is degenerate; the mean and standard deviation are 0.775 and 0, respectively. Figure 4 is a placeholder for the associated histogram.

## 2 Discussion

Random search located moderately capable Pac-Man controllers, but the hill climber provided a sizeable improvement of roughly 29.325 points on average. The uniform scores for the ghost runs suggest either an implementation bug or a controller that exploits deterministic behavior to capture Pac-Man immediately; verify the experiment setup before drawing firm conclusions.

## 3 Outstanding Tasks

- Document the controller’s observed behavior after watching the visualization playback and revise Section 1.2 accordingly.
- Replace every placeholder figure with the corresponding image assets prior to submission.

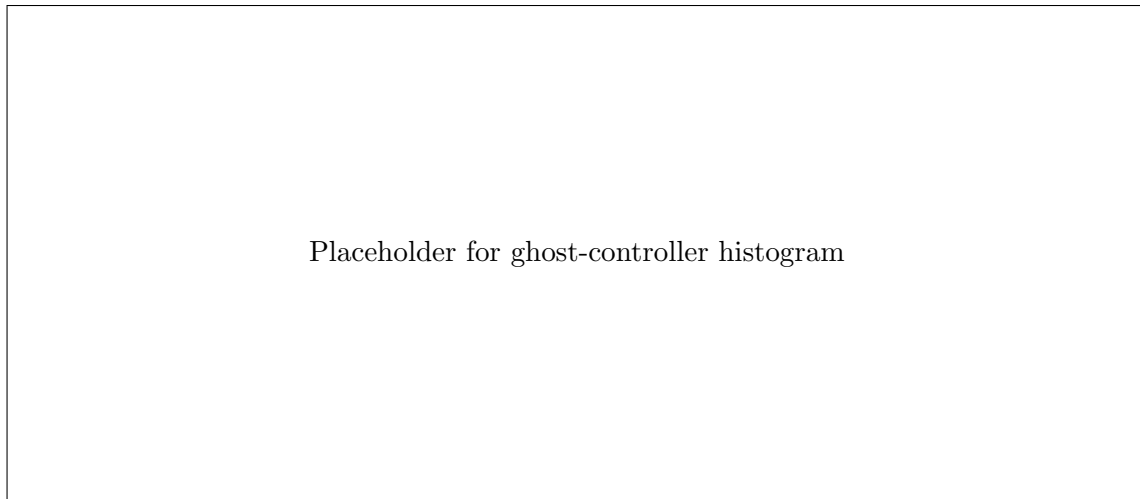


Figure 4: Placeholder for the ghost-controller score histogram (insert `data/2a/red1/histogram.png`).

## Reproducibility

All raw data required to regenerate the tables and plots are committed under the `data/2a` directory. A future revision should include scripts (e.g., in `scripts/`) to reproduce these artifacts end-to-end.