

Dysfunctional Organizational System

Testing Plan | Milestone 1

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Scope

Organization Hierarchy

Test Descriptions:

1. Verify that only one president can exist in the organization.
2. Verify that the president can hire up to two vice presidents.
3. Verify that each vice president can oversee up to three supervisors.
4. Verify that each supervisor can oversee up to five workers.
5. Verify that hiring a third vice president fails.
6. Verify that hiring a fourth supervisor fails under the same vice president.
7. Verify that hiring a sixth worker fails under the same supervisor.

Priority: #1

Dependencies: None

Is This Being Tested?: Yes, Equivalence Class Testing, Boundary Value Testing

Employee Management

Test Descriptions:

1. Verify that an employee can be properly added to the organization.
2. Verify that an employee's role can be updated after a promotion or transfer.
3. Verify that the correct employee is fired when a supervisor or manager initiates the process.

Priority: #2

Dependencies: Organization Hierarchy

Is This Being Tested?: Yes, Equivalence Class Testing, Boundary Value Testing

Employee Name Uniqueness

Test Descriptions:

1. Verify that no two employees can have the same name.
2. Verify that attempting to hire an employee with a duplicate name results in an error.

Priority: #3

Dependencies: Hiring Process

Is This Being Tested?: Yes, Equivalence Class Testing, Boundary Value Testing

Hiring Process

Test Descriptions:

1. Verify that a supervisor can hire a new worker when there is a vacancy.
2. Verify that a vice president can hire a new supervisor when there is a vacancy.
3. Verify that hiring fails if there is no vacancy available at the designated role.
4. Verify that an employee can only be hired by their immediate supervisor.

Priority: #1

Dependencies: Employee Name Uniqueness

Is This Being Tested?: Yes, Equivalence Class Testing, Boundary Value Testing

Firing Process

Test Descriptions:

1. Verify that a worker can be fired by their supervisor, and their position is filled by a worker from below.
2. Verify that a supervisor can be fired by their vice president, and their role is filled by a worker.
3. Verify that the president cannot be fired.
4. Verify that firing an employee who cannot be replaced does not leave a vacancy.

Priority: #1

Dependencies: Employee Management

Is This Being Tested?: Yes, Equivalence Class Testing, Boundary Value Testing

Quitting Process

Test Descriptions:

1. Verify that when a worker quits, their position is filled by another worker from below.
2. Verify that when a supervisor quits, a worker is promoted to take their place.
3. Verify that when a vice president quits, a supervisor is promoted to take their place.
4. Verify that the president cannot quit.

Priority: #2

Dependencies: Firing Process

Is This Being Tested?: Yes, Boundary Value Testing

Layoff Process

Test Descriptions:

1. Verify that a laid-off worker is transferred to another available position before being officially laid off.
2. Verify that a worker is laid off if no comparable position is available.
3. Verify that the closest possible move is made when transferring a laid-off worker.
4. Verify that a worker's position is fulfilled after a layoff.

Priority: #3

Dependencies: Employee Management

Is This Being Tested?: Yes, Equivalence Class Testing, Boundary Value Testing

Transfer Process

Test Descriptions:

1. Verify that a supervisor or worker can be transferred to another group if there is a vacancy. (Functional Testing)
2. Verify that a transfer request fails if no vacancy exists.
3. Verify that transfers occur at the same hierarchical level (e.g., worker to worker, supervisor to supervisor).
4. Verify that transfers do not change the organizational structure beyond the immediate group.

Priority: #3

Dependencies: Layoff Process

Is This Being Tested?: Yes, Equivalence Class Testing, Boundary Value Testing

Promotion Process

Test Descriptions:

1. Verify that a worker can be promoted to a supervisor position if there is a vacancy.
2. Verify that a supervisor can be promoted to a vice president if there is a vacancy.
3. Verify that promotions are only one level at a time.
4. Verify that no one can be promoted to president.
5. Verify that promotions are initiated by the receiving manager.

Priority: #2

Dependencies: Employee Management

Is This Being Tested?: Yes, Equivalence Class Testing

File Input & Output

Test Descriptions:

1. Verify that the organization can be initialized from a valid file.
2. Verify that an error message is displayed when attempting to load an invalid file.
3. Verify that the organization structure is saved correctly to a file after any change.

Priority: #1

Dependencies: Organization Hierarchy, Employee Management

Is This Being Tested?: Yes, Equivalence Class Testing

Initializing Organization from a File

Test Descriptions:

1. Verify that the organization is correctly initialized from a well-structured file.
2. Verify that no employee is added if the file exceeds the organizational limits (e.g., more than two vice presidents).
3. Verify that hierarchical relationships are properly restored from the file.

Priority: #1

Dependencies: File Input & Output

Is This Being Tested?: Yes, Boundary Value Testing

Error Handling for Invalid Files

Test Descriptions:

1. Verify that an error message is shown if the file is improperly formatted.
2. Verify that an error message is displayed when attempting to load a file with invalid employee relationships.
3. Verify that invalid employee counts (more than allowed in the hierarchy) are rejected.

Priority: #3

Dependencies: File Input & Output

Is This Being Tested?: Yes, Equivalence Class Testing, Boundary Value Testing

Display Current Organization

Test Descriptions:

1. Verify that the current organization is displayed correctly after changes to the hierarchy.
2. Verify that the organization doesn't display vacancies.
3. Verify that the president is always displayed, even if the rest of the organization is vacant.

Priority: #2

Dependencies: Organization Hierarchy, Employee Management

Is This Being Tested?: Yes, Equivalence Class Testing

Testing Strategies

Equivalence Class Testing

Strategy One - Equivalence Class Testing

- **Strategy Type:** Equivalence Class Testing
- **White/Black Box:** Black Box
- **Technique:** Manual Unit Testing

Entry Criteria:

- The user must be able to perform all core operations of the Dysfunctional Organization System from start to finish. These include adding employees, hiring, firing, promoting, transferring, quitting, and managing layoffs. The system should also handle file inputs/outputs and display the current organization structure.

Exit Criteria:

- 80% of tests pass with no critical bugs.
- The system operates as expected under normal conditions (e.g., organizational hierarchy is maintained, processes are working as defined).

Command	Equivalence Classes	Valid Input	Invalid Input
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Add Employee	Valid: Employee name is unique	Employee name is not already in use	Employee name already exists
	Invalid: Duplicate employee name	Invalid name format (e.g., special characters)	Name is empty or blank
Hire Employee	Valid: Hiring occurs when a vacancy is available	Position is available for hire (worker, supervisor, etc.)	No vacancy available for the designated position
	Invalid: No vacancy available	Invalid position title	Invalid employee role
Fire Employee	Valid: Employee can be fired	Employee exists in the organization	No such employee exists in the system
	Invalid: Attempting to fire non-existent employee	Employee is not within the specified hierarchy level	Firing the president
Transfer Employee	Valid: Transfer between available roles	Transfer happens within the same hierarchy level	Invalid position for transfer
	Invalid: No vacancy for transfer	Invalid hierarchy levels for transfer	Transfer beyond the organization structure
Promote Employee	Valid: Promotion within allowable hierarchy	Promotion happens one level at a time (worker → supervisor → VP)	Invalid promotion (promoting beyond available hierarchy)
	Invalid: Invalid hierarchy promotion	No vacancy in the role for promotion	Attempt to promote to president
Quit Process	Valid: Employee can quit and role filled	A worker can be replaced by another worker	No replacement available
	Invalid: Attempt to quit when not allowed	Quitting for positions that do not allow quitting	The president cannot quit
Layoff Process	Valid: Worker laid off if no position available	Worker gets transferred to an available position before layoff	No transfer option for the laid-off worker
	Invalid: Layoff without replacement	Invalid layoff (e.g., not qualified for layoff)	Attempting to lay off a supervisor
Error Handling for	Valid: File is structured correctly	File can be loaded successfully	Invalid format (e.g., missing required data)

Invalid Files			
	Invalid: File with incorrect data or format	File has the correct hierarchy and relationships	File exceeds organizational limits (too many employees)
Display Organization	Valid: Organization displayed correctly	The current structure of employees is shown	Invalid display (incorrect hierarchical levels)
	Invalid: Display failure due to invalid data	Only supervisors are displayed, no workers	Display contains incorrect employee names

Boundary Value Testing

Strategy Two – Boundary Value Testing

- **Strategy Type:** Boundary Value Testing
- **White/Black Box:** Black Box
- **Technique:** Manual Unit Testing

Entry Criteria for Boundary Value Testing (BVT): All boundary values and edge cases for the system have been identified and documented.

Exit Criteria for Boundary Value Testing (BVT): All boundary values and edge cases for the system have been identified and documented.

Boundary Value Tests	Expected Input	Description	Expected Output
Add Employee	Valid: Unique employee name	The system allows adding an employee with a unique name	The employee is successfully added to the system
	Invalid: Duplicate employee name	The system rejects an employee with a name that already exists	The system returns an error message stating that the name is taken
	Invalid: Empty name	The system rejects empty or blank employee names	The system returns an error message indicating that the name is required

Hire Employee	Valid: Available position for hire (worker, supervisor)	The system hires an employee for an available position	The employee is successfully hired into the system
	Invalid: No vacancy for position	The system rejects the hire if no vacancy is available	The system returns an error stating that no vacancy exists for the position
	Invalid: Invalid position title	The system rejects hiring for an invalid position	The system returns an error stating the invalid position
Fire Employee	Valid: Employee exists and can be fired	The system fires an employee who exists in the organization	The employee is successfully fired
	Invalid: Firing non-existent employee	The system rejects the attempt to fire an employee who does not exist	The system returns an error message stating the employee doesn't exist
	Invalid: Firing the president	The system prevents firing the president	The system returns an error stating that the president cannot be fired
Transfer Employee	Valid: Transfer between available roles	The system transfers an employee to another position if there's a vacancy	The employee is successfully transferred to the new position
	Invalid: No vacancy for transfer	The system rejects a transfer request if no vacancy exists in the target position	The system returns an error stating no vacancy for transfer
	Invalid: Invalid position for transfer	The system rejects an invalid transfer to a non-existent role	The system returns an error stating the invalid role
Promotion Process	Valid: Promotion within allowable hierarchy	The system promotes a worker to supervisor or vice president if there's a vacancy	The employee is promoted to the next available position
	Invalid: Attempting promotion beyond hierarchy	The system rejects an attempt to promote beyond the allowable hierarchy (e.g.,	The system returns an error stating promotions cannot go beyond the hierarchy

		promoting a worker to president)	
	Invalid: No vacancy for promotion	The system rejects promotion if no vacancy exists for the role	The system returns an error stating no vacancy for promotion
Layoff Process	Valid: Worker is transferred before being laid off	The system transfers a worker to an available position before laying them off	The worker is transferred successfully
	Invalid: No available transfer for layoff	The system rejects laying off a worker if there's no available position	The system returns an error stating no available transfer
	Invalid: Invalid layoff for non-eligible role	The system prevents layoffs of roles that are not eligible for layoff (e.g., the president)	The system returns an error stating the employee cannot be laid off
Quitting Process	Valid: Worker quits and role is filled	The system replaces a worker who quits with a new worker from the pool	The worker quits, and the role is filled successfully
	Invalid: Attempt to quit when not allowed	The system prevents quitting from roles that do not allow quitting (e.g., the president)	The system returns an error stating quitting is not allowed for that role
	Invalid: No replacement available	The system rejects quitting if no replacement is available	The system returns an error stating no replacement for quitting employee
File Input & Output	Valid: File is structured correctly	The system loads a file with the correct format and data	The system loads the data successfully into the system
	Invalid: File with incorrect format	The system rejects loading a file with an incorrect format	The system returns an error stating the file format is incorrect
	Invalid: File exceeds organizational limits	The system rejects loading a file with more employees than allowed in the hierarchy	The system returns an error stating the file exceeds the organizational limit

Display Organization	Valid: Organization displayed correctly	The system displays the current hierarchy of employees correctly	The current organization structure is displayed as expected
	Invalid: Display of incorrect hierarchical levels	The system rejects displaying an incorrect organizational structure	The system returns an error or does not display the hierarchy properly
	Invalid: Missing employee data	The system fails to display employees due to missing data	The system returns an error or an incomplete display
Organization Hierarchy Constraints	Valid: No more than two vice presidents for the president	The system allows a maximum of two vice presidents under the president	The president can have exactly two vice presidents
	Invalid: Attempting to hire a third vice president	The system rejects hiring a third vice president for the president	The system returns an error stating that no more than two vice presidents can exist
	Valid: Each vice president can have up to three supervisors	The system allows a maximum of three supervisors per vice president	Each vice president can manage up to three supervisors
	Invalid: Attempting to hire a fourth supervisor under the same vice president	The system rejects hiring a fourth supervisor under the same vice president	The system returns an error stating that no more than three supervisors can exist under the same vice president
	Valid: Each supervisor can have up to five workers	The system allows a supervisor to manage up to five workers	Each supervisor can manage a maximum of five workers
	Invalid: Attempting to hire a sixth worker under the same supervisor	The system rejects hiring a sixth worker under the same supervisor	The system returns an error stating that no more than five workers can be managed by the same supervisor

Code Review

Strategy Three – Code Review

Implementation:

- **GitHub PRs:** All code changes will be submitted through pull requests (PRs) on GitHub, where they will be reviewed by team members.
- **Review Process:** Each PR will be checked for functionality, code quality, testing, security, performance, and documentation.
- **Approval and Merging:** Code will be merged into the main branch only after passing the review and automated tests.
- **Tools:** GitHub will be used for reviews, with CI/CD pipelines ensuring automated testing on each PR.

Resources

Team Members: Cameron Seppi, Vadim Pidoshva, Jessica Adams, Trajan Clark

Hardware: Windows 11, macOS

Software: VS Code, IntelliJ, Github, Python

Timeline

Task 1: Set up test environment & develop unit tests

- **Starts:** 09/19/2024
- **Precedes:** Unit testing

Task 2: Execute unit tests & start integration testing

- **Starts:** 09/26/2024
- **Precedes:** Manual testing

Task 3: Conduct manual testing

- **Starts:** 10/01/2024
- **Precedes:** Finalization

Task 4: Finalize testing & prepare documentation

- **Starts:** 10/04/2024
- **Ends:** Before review

Contingency Buffer

- **Additional Time:** A buffer of **2–5 days** can be allocated throughout the testing process to accommodate any unforeseen delays or issues.
- **Reevaluation:** At the end of each week, assess the progress against the planned schedule. If critical delays are anticipated, reallocate tasks or adjust the timeline accordingly.

Risks

Several risks could affect the testing process and project timeline:

- **Scope Creep:** Additional requirements may emerge during testing, potentially extending the timeline.
- **Resource Availability:** Team members may have conflicting commitments, impacting testing coverage.
- **Complexity of the System:** The intricate hierarchy and rules could lead to unforeseen bugs, requiring additional time for resolution.
- **File Input Errors:** If the organization initialization file has issues, it could lead to significant failures in the system.

Testing Log

Test Cases

1. Organization Hierarchy Tests

Test Case 1.1

Verify that only one president can exist in the organization.

Input: Attempt to read a file with more than one president.

Expected Outcome: An error message

Test Case 1.2

Verify that the president can hire up to two vice presidents.

Input: Hire two vice presidents.

Expected Outcome: Both vice presidents are hired successfully.

Test Case 1.3

Verify that hiring a third vice president fails.

Input: Attempt to hire a third vice president.

Expected Outcome: An error message indicating the vice president limit has been reached.

Test Case 1.4

Verify that each vice president can oversee up to three supervisors.

Input: Hire three supervisors under one vice president.

Expected Outcome: All three supervisors are hired successfully.

Test Case 1.5

Verify that hiring a fourth supervisor fails under the same vice president.

Input: Attempt to hire a fourth supervisor under a vice president who already has three supervisors.

Expected Outcome: An error message indicating the supervisor limit has been reached.

Test Case 1.6

Verify that each supervisor can oversee up to five workers.

Input: Hire five workers under one supervisor.

Expected Outcome: All five workers are hired successfully.

Test Case 1.7

Verify that hiring a sixth worker fails under the same supervisor.

Input: Attempt to hire a sixth worker under a supervisor who already has five workers.

Expected Outcome: An error message indicating the worker limit has been reached.

2. Employee Name Uniqueness Tests

Test Case 2.1

Verify that no two employees can have the same name.

Input: Attempt to hire two employees with the same name.

Expected Outcome: An error message indicating that the name is already taken by another employee.

4. Firing Tests

Test Case 4.1

Verify that a worker can be fired by their immediate supervisor and their role is immediately replaced.

Input: A supervisor fires a worker, and one of the remaining workers is promoted to fill the vacancy.

Expected Outcome: The worker is removed from the organization, and a replacement is automatically promoted from the lower level.

Test Case 4.2

Verify that a supervisor can be fired by their immediate vice president, with replacement from below.

Input: A vice president fires a supervisor, and one of the workers is promoted to fill the

supervisor position.

Expected Outcome: The supervisor is removed, and a worker is promoted to replace them.

Test Case 4.3

Verify that a vice president can be fired by the president, and someone from below fills the vacancy.

Input: The president fires a vice president, and a supervisor is promoted to the vice president role.

Expected Outcome: The vice president is removed, and a supervisor from below is promoted to replace them.

Test Case 4.4

Verify that firing does not create a vacancy unless no one is available to replace the position.

Input: Fire a worker, supervisor, or vice president in a fully populated organization.

Expected Outcome: The person is fired and replaced by the next available person in the hierarchy. If no one is available to replace them, the position remains vacant.

5. Quitting Tests

Test Case 5.1

Verify that an employee can quit and their position is immediately filled by a replacement from below.

Input: A worker quits, and another worker is promoted to take their place.

Expected Outcome: The worker is removed from the organization, and a replacement is promoted from below.

Test Case 5.2

Verify that when a supervisor or vice president quits, someone from below takes their place if available.

Input: A supervisor quits, and a worker is promoted to fill their position.

Expected Outcome: The supervisor is removed, and the next worker is promoted to replace them.

6. Layoff Tests

Test Case 6.1

Verify that a laid-off worker is first transferred to any available opening before being officially laid off.

Input: Lay off a worker, and the system attempts to transfer them to another available position before laying them off.

Expected Outcome: The worker is automatically transferred to an open position if one exists. If no position is available, they are laid off.

Test Case 6.2

Verify that if no comparable position is available, the worker is laid off.

Input: Lay off a worker when no other positions are available.

Expected Outcome: The worker is removed from the organization with an appropriate message indicating there were no open positions to transfer them to.

7. Transfer Tests

Test Case 7.1

Verify that workers are automatically transferred to another supervisory group if there is a vacancy.

Input: Lay off or fire a worker, and check for an automatic transfer to another supervisory group.

Expected Outcome: The worker is automatically transferred to the first available supervisory group with an open position. There is no manual selection of the destination group.

Test Case 7.2

Verify that a transfer fails if no vacancy is available in any supervisory group.

Input: Attempt to transfer a worker when no open positions are available.

Expected Outcome: An error message indicating that no vacancy exists for the transfer.

8. Promotion Tests

Test Case 8.1

Verify that a worker can be promoted to a supervisor position if there is a vacancy, or if the current supervisor is removed.

Input: A supervisor promotes a worker to a supervisor position.

Expected Outcome: The worker is promoted successfully, and their previous position is now filled by another worker.

Test Case 8.2

Verify that promotions cannot happen if no vacancy exists and the position is filled.

Input: Attempt to promote a worker when no supervisor or worker vacancy exists.

Expected Outcome: An error message indicating no vacancy for promotion is available.

9. File Input Tests

Test Case 9.1

Verify that the organization can be initialized from a valid file.

Input: Load an organization hierarchy from a correctly formatted file.

Expected Outcome: The organization is set up correctly as per the file's contents.

Test Case 9.2

Verify error handling when loading a file that exceeds hierarchy limits (e.g., too many vice presidents or supervisors).

Input: Attempt to load a file that specifies more employees than allowed by the organization structure.

Expected Outcome: An error message indicating the file contains invalid hierarchy data.

Test Case 9.3

Verify error handling when loading from an improperly formatted file.

Input: Attempt to load an invalid or improperly formatted file.

Expected Outcome: An error message indicating the file cannot be loaded due to format errors.

10. Display Tests

Test Case 10.1

Verify that the organization structure is displayed correctly after hires, promotions, and terminations.

Input: Call the display function after several operations (hires, promotions, terminations).

Expected Outcome: The organization hierarchy is displayed correctly with all positions filled where applicable.

Test Case 10.2

Verify that vacancies are displayed correctly only if no one is available to fill a role.

Input: Create a situation where a role cannot be filled due to lack of available employees, and display the organization.

Expected Outcome: The position is shown as vacant only if no one is available to take the position.

Testing Records

1. Organization Hierarchy Tests

- **Test Case 1.1:** Verify that only one president can exist in the organization.
Verified: Yes, by Cameron 10/5
- **Test Case 1.2:** Verify that the president can hire up to two vice presidents.
Verified: Yes, by Cameron 10/5
- **Test Case 1.3:** Verify that hiring a third vice president fails.
Verified: Yes, by Cameron 10/5

- **Test Case 1.4:** Verify that each vice president can oversee up to three supervisors.
Verified: Yes, by Cameron 10/5
 - **Test Case 1.5:** Verify that hiring a fourth supervisor fails under the same vice president.
Verified: Yes, by Cameron 10/5
 - **Test Case 1.6:** Verify that each supervisor can oversee up to five workers.
Verified: Yes, by Cameron 10/5
 - **Test Case 1.7:** Verify that hiring a sixth worker fails under the same supervisor.
Verified: Yes, by Cameron 10/5
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2. Employee Name Uniqueness Tests

- **Test Case 2.1:** Verify that no two employees can have the same name.
Verified: Yes, by Cameron 10/5
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4. Firing Tests

- **Test Case 4.1:** Verify that a worker can be fired by their immediate supervisor and their role is immediately replaced.
Verified: Yes, by Cameron 10/5
 - **Test Case 4.2:** Verify that a supervisor can be fired by their immediate vice president, with replacement from below.
Verified: Yes, by Cameron 10/5
 - **Test Case 4.3:** Verify that a vice president can be fired by the president, and someone from below fills the vacancy.
Verified: Yes, by Cameron 10/5
 - **Test Case 4.4:** Verify that firing does not create a vacancy unless no one is available to replace the position.
Verified: Yes, by Cameron 10/5
-

5. Quitting Tests

- **Test Case 5.1:** Verify that an employee can quit and their position is immediately filled by a replacement from below.
Verified: Yes, by Cameron 10/5
 - **Test Case 5.2:** Verify that when a supervisor or vice president quits, someone from below takes their place if available.
Verified: Yes, by Cameron 10/5
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6. Layoff Tests

- **Test Case 6.1:** Verify that a laid-off worker is first transferred to any available opening before being officially laid off.
Verified: Yes, by Jessica 10/6
 - **Test Case 6.2:** Verify that if no comparable position is available, the worker is laid off.
Verified: Yes, by Jessica 10/6
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7. Transfer Tests

- **Test Case 7.1:** Verify that workers are automatically transferred to another supervisory group if there is a vacancy.
Verified: Yes, by Jessica 10/6
 - **Test Case 7.2:** Verify that a transfer fails if no vacancy is available in any supervisory group.
Verified: Yes, by Jessica 10/6
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8. Promotion Tests

- **Test Case 8.1:** Verify that a worker can be promoted to a supervisor position if there is a vacancy, or if the current supervisor is removed.
Verified: Yes, by Jessica 10/6
 - **Test Case 8.2:** Verify that promotions cannot happen if no vacancy exists and the position is filled.
Verified: Yes, by Jessica 10/6
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9. File Input Tests

- **Test Case 9.1:** Verify that the organization can be initialized from a valid file.
Verified: Yes, by Jessica 10/6
 - **Test Case 9.2:** Verify error handling when loading a file that exceeds hierarchy limits (e.g., too many vice presidents or supervisors).
Verified: Yes, by Jessica 10/6
 - **Test Case 9.3:** Verify error handling when loading from an improperly formatted file.
Verified: Yes, by Jessica 10/6
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10. Display Tests

- **Test Case 10.1:** Verify that the organization structure is displayed correctly after hires, promotions, and terminations.
Verified: Yes, by Jessica 10/6
- **Test Case 10.2:** Verify that vacancies are displayed correctly only if no one is available to fill a role.
Verified: Yes, by Jessica 10/6