PiTech Testing for Keogh's Ports

Test Cases:

By Nov 30th, 2024, we identified the following test cases:

Balance

- Handle an empty ship without performing any moves
- A single container is in the correct position, and no moves should be made
- A single container that needs one move to be balanced
- Two containers (one needs moving), one container is placed on one side and must be moved to the opposite side *ShipCase1*
- All Containers on one side *ShipCase3*
- All containers on one column *ShipCase4*
- Balance different container distributions up to 30 containers

Transfer

- Test unloading all containers from the ship
- Test unloading containers that are blocked by others
- Test loading containers into an empty ship
- Test loading containers into empty slots and unloading containers from different slots, ensuring no overlap
- Load container with no name
- Load container with negative weight
- Attempt to load 0 Quantity of a container

Test Results:

- **Date:** Dec 12th, 2024
- Below are the results of evaluating the efficiency of all operations under varying container counts for effective container ship management

Balance

Test Case	Containers	Run Time	Notes	Result
Empty Ship	0	> 0.01s		Pass
OneNoMove	1	>0.01s		
OneNeedsMove	1	>0.01s		Pass
ShipCase1	2	0.1s		Pass
ShipCase2	4	8s		Pass
ShipCase3	6	13s		Pass
ShipCase4	7	92s	Vertical cluster	Pass
ShipCase5	5	>900s		Fail
ShipCase6	4	16s		Pass
ShipCas	20	33.9s		Pass
Case8	23	211s		Pass
Case9	24	0.7s		Pass
Case10	26	>900s		Fail
Case11	27	19.7s		Pass
Case12	28	2.3s		Pass
Case13	29	>900s		Fail
Case14	30	12.3s		Pass
Case15	31	>900s		Fail

Transfer

Test Case	Containers	Load	Unload	Run Time	Result
ShipCase1	2	0	1	0s	Pass
ShipCase2	4	1	0	0s	Pass
ShipCase3	6	2	1	26s	Pass
ShipCase4	7	2	1	2s	Pass
ShipCase5	4	3	1	14s	Pass
ShipCase6	20	2	2	13s	Pass

Screenshots:

Balance

- Empty ship:

```
========================================
Balancing job selected for test_empty.txt.
Path is Empty. No optimal movements available

Balancing completed in 0.0 seconds.
========================================
```

- One container, needs one move:

```
========================================
Balancing job selected for test_one_move.txt.
Not balanceable.
Beginning SIFT Operation
Sifting...
Balance Moves:
Move container from position (0, 0), to position (0, 5), Time estimation: 13 minutes
Move crane from position (0, 5) to position (8, 0), Time estimation: 13 minutes

Balancing completed in 0.3 seconds.
========================================
```

- One container in correct position:

```
========================================
Balancing job selected for test_one_no_move.txt.
Not balanceable.
Beginning SIFT Operation
Sifting...
No movements needed

Balancing completed in 0.0 seconds.
========================================
```

- Balance ShipCase(1~6):

```
Balance Moves for ShipCase1.txt:
Move container from position (0, 2) to position (0, 6), Time estimation: 14 minutes
Move crane from position (0, 6) to position (8, 0), Time estimation: 14 minutes

Balancing for ShipCase1.txt completed in 0.1 seconds.
========================================

Balance Moves for ShipCase2.txt:
Move container from position (0, 3) to position (0, 6), Time estimation: 14 minutes
Move container from position (0, 8) to position (0, 5), Time estimation: 7 minutes
Move crane from position (0, 5) to position (8, 0), Time estimation: 13 minutes

Balancing for ShipCase2.txt completed in 8.4 seconds.
========================================

Balance Moves for ShipCase3.txt:
Move container from position (1, 0) to position (2, 1), Time estimation: 9 minutes
Move container from position (0, 0) to position (0, 6), Time estimation: 15 minutes
Move crane from position (0, 6) to position (8, 0), Time estimation: 14 minutes

Balancing for ShipCase3.txt completed in 13.1 seconds.
========================================

Balance Moves for ShipCase4.txt:
Move container from position (7, 4) to position (1, 3), Time estimation: 12 minutes
Move container from position (6, 4) to position (1, 6), Time estimation: 13 minutes
Move container from position (5, 4) to position (2, 3), Time estimation: 10 minutes
Move container from position (4, 4) to position (2, 6), Time estimation: 7 minutes
Move crane from position (2, 6) to position (8, 0), Time estimation: 12 minutes

Balancing for ShipCase4.txt completed in 92.8 seconds.
========================================

Balance Moves for ShipCase6.txt:
Move container from position (1, 1) to position (1, 2), Time estimation: 9 minutes
Move container from position (0, 1) to position (0, 6), Time estimation: 11 minutes
Move crane from position (0, 6) to position (8, 0), Time estimation: 14 minutes

Balancing for ShipCase6.txt completed in 16.1 seconds.
========================================
```

- Balance 20~30 containers:

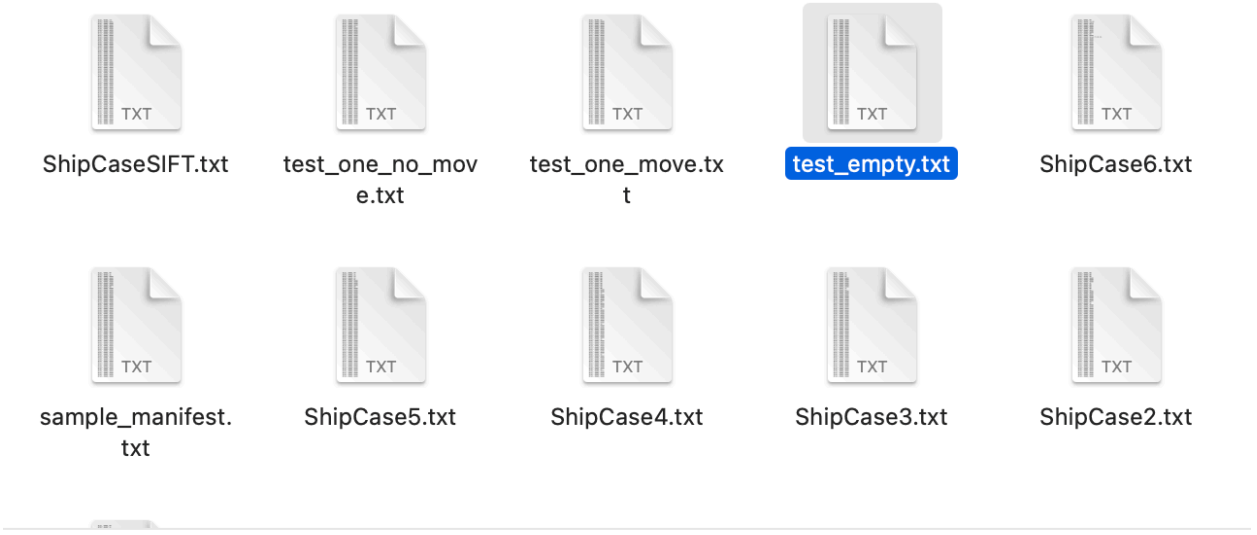
```
----------------------------------------
Balancing job selected for 20Containers.txt.

Balance Moves for 20Containers.txt:
Move container from position (1, 6) to position (1, 5), Time estimation: 14 minutes
Move container from position (0, 6) to position (2, 5), Time estimation: 5 minutes
Move crane from position (2, 5) to position (8, 0), Time estimation: 11 minutes

Balancing for 20Containers.txt completed in 33.9 seconds.


Balance Moves for 22Containers.txt:
Move container from position (3, 0) to position (1, 6), Time estimation: 15 minutes
Move container from position (1, 5) to position (2, 6), Time estimation: 3 minutes
Move crane from position (2, 6) to position (8, 0), Time estimation: 12 minutes

Balancing for 22Containers.txt completed in 19.1 seconds.
========================================
Balancing job selected for 23Containers.txt.

Balance Moves for 23Containers.txt:
Move container from position (3, 6) to position (2, 4), Time estimation: 14 minutes
Move container from position (2, 6) to position (3, 4), Time estimation: 5 minutes
Move crane from position (3, 4) to position (8, 0), Time estimation: 9 minutes

Balancing for 23Containers.txt completed in 211.6 seconds.
========================================
Balancing job selected for 24Containers.txt.

Balance Moves for 24Containers.txt:
Move container from position (2, 2) to position (3, 6), Time estimation: 13 minutes
Move crane from position (3, 6) to position (8, 0), Time estimation: 11 minutes

Balancing for 24Containers.txt completed in 0.7 seconds.
----------------------------------------



Balance Moves for 30Containers.txt:
Move container from position (5, 6) to position (0, 5), Time estimation: 15 minutes
Move crane from position (0, 5) to position (8, 0), Time estimation: 13 minutes

Balancing for 30Containers.txt completed in 12.3 seconds.
========================================
```

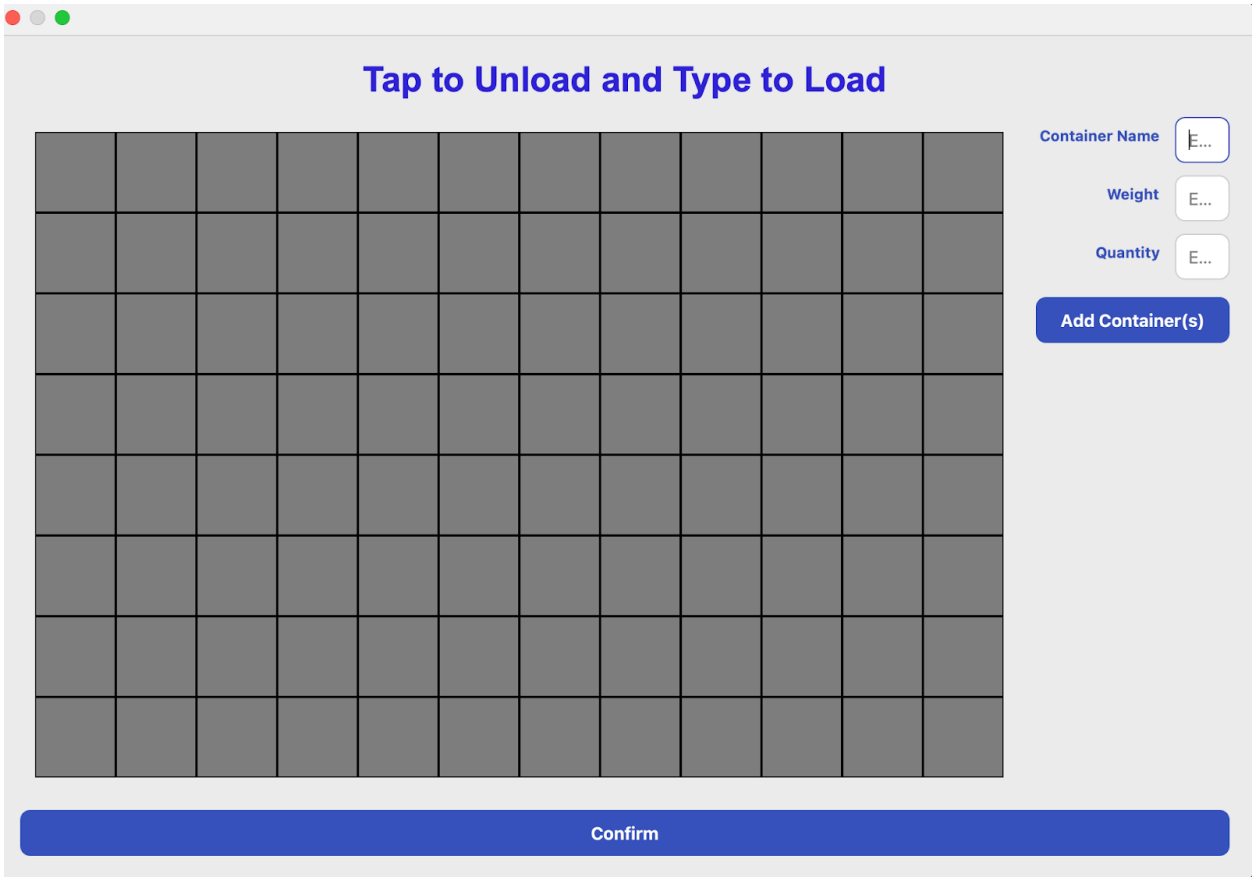
Transfer

- Transfer ShipCase(1~6):

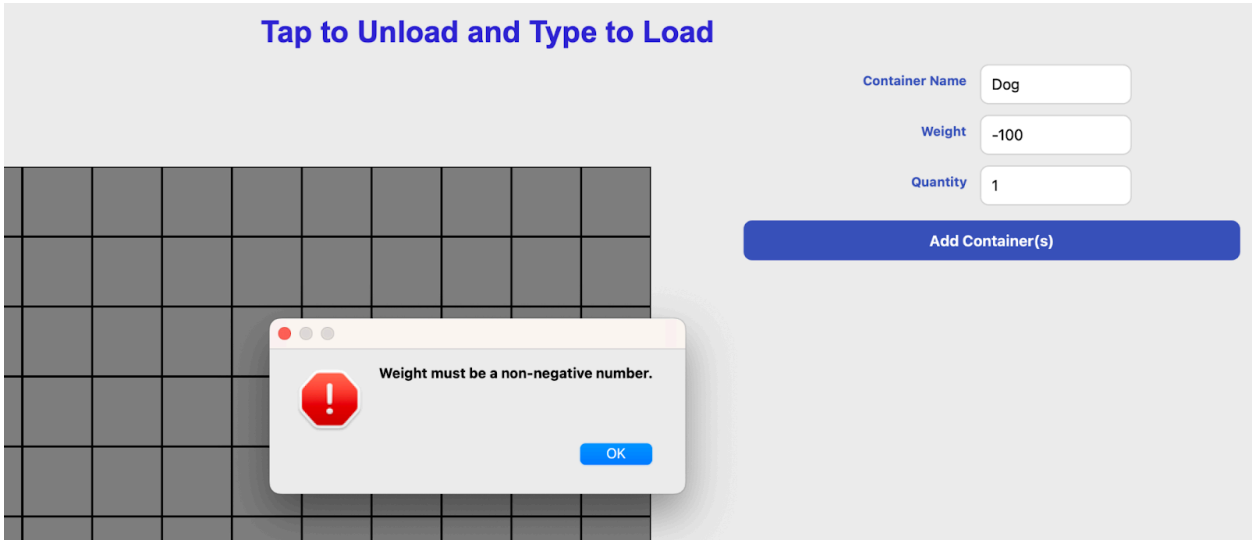
```
Transfer Moves for ShipCase1.txt:
Move container from position (0, 1) to position truck, Time estimation: 20 minutes
Move crane from position truck to position (8, 0), Time estimation: 2 minutes

Transferring for ShipCase1.txt completed in 0.0 seconds.
========================================
load,Bat,431

Transferring job selected for ShipCase2.txt.

Transfer Moves for ShipCase2.txt:
Move container from position truck to position (3, 0), Time estimation: 9 minutes
Move crane from position (3, 0) to position (8, 0), Time estimation: 5 minutes

Transferring for ShipCase2.txt completed in 0.1 seconds.
========================================
load,Bat,532

load,Rat,6317

unload,Cow

Transferring job selected for ShipCase3.txt.

Transfer Moves for ShipCase3.txt:
Move container from position truck to position (2, 0), Time estimation: 10 minutes
Move container from position (1, 1) to position (1, 2), Time estimation: 3 minutes
Move container from position (0, 1) to position truck, Time estimation: 13 minutes
Move container from position truck to position (3, 0), Time estimation: 7 minutes
Move crane from position (3, 0) to position (8, 0), Time estimation: 5 minutes

Transferring for ShipCase3.txt completed in 26.1 seconds.
========================================
load,Nat,2543

unload,Doe

Transferring job selected for ShipCase4.txt.

Transfer Moves for ShipCase4.txt:
Move container from position (7, 4) to position (1, 3), Time estimation: 12 minutes
Move container from position (6, 4) to position truck, Time estimation: 14 minutes
Move container from position truck to position (6, 4), Time estimation: 8 minutes
Move crane from position (6, 4) to position (8, 0), Time estimation: 6 minutes

Transferring for ShipCase4.txt completed in 2.3 seconds.
========================================
```

- Using transfer on empty ship
    - Initializes an empty grid ready for loading

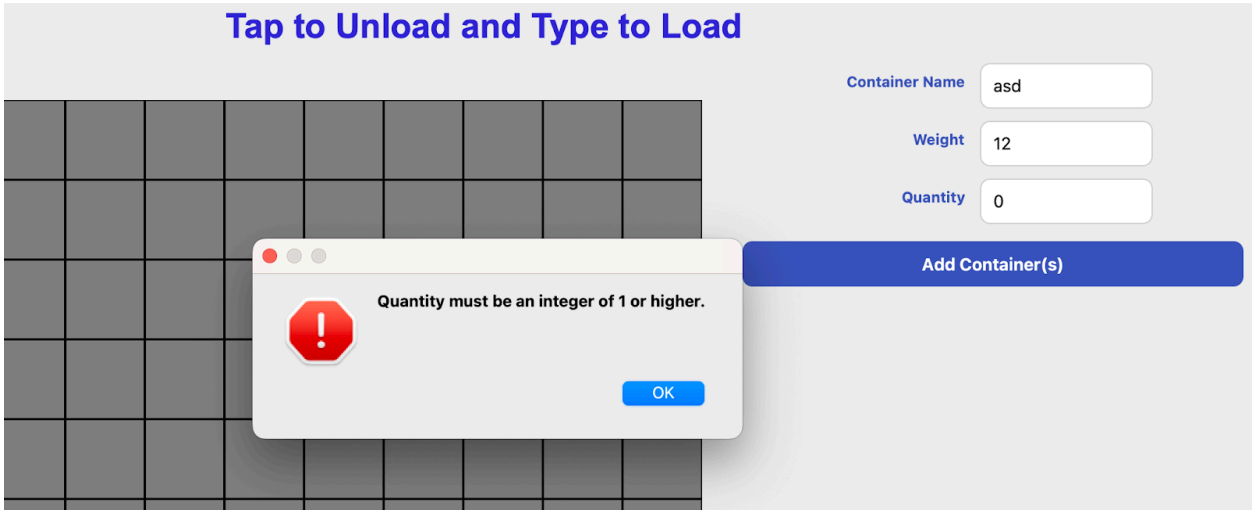




- Attempt to load a negative-weight container



- Attempt to load 0 Quantity of a container



- Attempt to load a container without a name