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Professor Depew
ASTE475
29 October 2025

Homework 5 Report

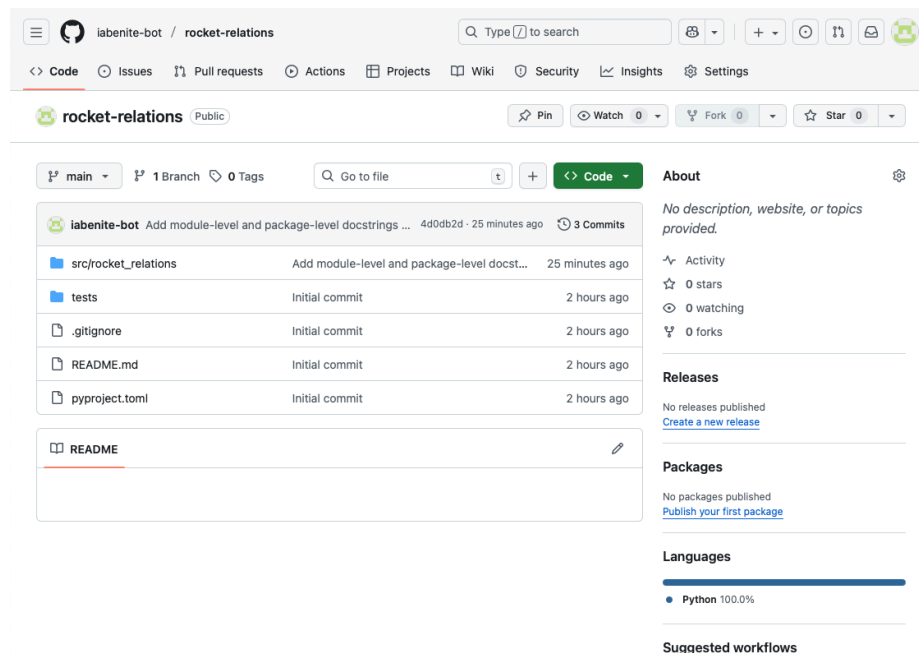
Part 1:

- a) Part a was simple, it was just making the directory layout for the assignment. I didn't have any trouble completing this part.

```
rocket-relations — -zsh — 156x39

Last login: Tue Oct 28 13:56:45 on ttys000
(base) ivanbenitez@Mac-126 ~ % conda activate aste404
(aste404) ivanbenitez@Mac-126 ~ % mkdir -p rocket-relations/src/rocket_relations
(aste404) ivanbenitez@Mac-126 ~ % mkdir -p rocket-relations/tests
(aste404) ivanbenitez@Mac-126 ~ % cd rocket-relations
(aste404) ivanbenitez@Mac-126 rocket-relations % touch pyproject.toml
(aste404) ivanbenitez@Mac-126 rocket-relations % touch README.md
(aste404) ivanbenitez@Mac-126 rocket-relations % touch .gitignore
(aste404) ivanbenitez@Mac-126 rocket-relations % touch src/rocket_relations/__init__.py
(aste404) ivanbenitez@Mac-126 rocket-relations % touch src/rocket_relations/ideal.py
(aste404) ivanbenitez@Mac-126 rocket-relations % touch tests/test_ideal.py
(aste404) ivanbenitez@Mac-126 rocket-relations %
```

- b) Part b was also simple, it was similar to the last homework. I ran into no issues here



- c) This part of the assignment was difficult. I spent a majority of the time here because of the expensive googling I had to do. I eventually got it completed though.

```
UW PICO 5.09 File: __init__.py

"""
rocket_relations package

This package provides tools for evaluating ideal rocket performance metrics
based on standard ideal flow assumptions.

"""

from .ideal import c_star, c_f

__all__ = ["c_star", "c_f"]

^G Get Help    ^O WriteOut    ^R Read File    ^Y Prev Pg    ^K Cut Text    ^C Cur Pos
^X Exit        ^J Justify     ^W Where is    ^V Next Pg    ^U UnCut Text  ^T To Spell
```

- d) Part d was simple, I just followed the instructions.

```
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This package provides tools for evaluating ideal rocket performance metrics
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^X Exit        ^J Justify     ^W Where is    ^V Next Pg    ^U UnCut Text  ^T To Spell
```

e) Part e also wasn't too difficult. I did not struggle much completing it.

```
UW PICO 5.09 File: pyproject.toml

[build-system]
requires = ["hatchling >= 1.26"]
build-backend = "hatchling.build"

[project]
name = "rocket-relations"
version = "0.1.0"
description = "Basic ideal rocket relations"
readme = "README.md"
requires-python = ">=3.10"
dependencies = ["numpy"]
```

```
(aste404) ivanbenitez@Mac-126 rocket-relations % python
Python 3.13.7 | packaged by conda-forge | (main, Sep 3 2025, 14:24:46) [Clang 19.1.7 ] on darwin
Type "help", "copyright", "credits" or "license" for more information.
[>>> from rocket_relations import c_star, c_f
[>>> gamma = 1.2
[>>> R = 287
[>>> T0 = 3000
[>>> c_star(gamma, R, T0)
np.float64(1430.7729507626036)
[>>> ]
```

f) Part f took some time but I was able to figure it out with some googling.

```
UW PICO 5.09 File: test_ideal.py

import pytest
import numpy as np
from rocket_relations import c_star, c_f

def test_c_star():
    gamma = 1.2
    R = 350
    T0 = 3500
    result = c_star(gamma, R, T0)
    assert np.isclose(result, 1706.6214, rtol=1e-5)

def test_c_f():
    gamma = 1.2
    pe_p0 = 0.0125
    pa_p0 = 0.02
    area_ratio = 10
    result = c_f(gamma, pe_p0, pa_p0, area_ratio)
    assert np.isclose(result, 1.5423079, rtol=1e-5)
```

```
((aste404) ivanbenitez@Mac-126 rocket-relations % pytest
===== test session starts =====
platform darwin -- Python 3.13.7, pytest-8.4.2, pluggy-1.6.0
rootdir: /Users/ivanbenitez/rocket-relations
configfile: pyproject.toml
plugins: anyio-4.11.0
collected 2 items

tests/test_ideal.py .. [100%]

===== 2 passed in 0.08s =====
((aste404) ivanbenitez@Mac-126 rocket-relations %
```

```
((aste404) ivanbenitez@Mac-126 ~ % cd rocket-relations
((aste404) ivanbenitez@Mac-126 rocket-relations % git status
On branch main
Your branch is up to date with 'origin/main'.

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   pyproject.toml
        modified:   tests/test_ideal.py

no changes added to commit (use "git add" and/or "git commit -a")
((aste404) ivanbenitez@Mac-126 rocket-relations % git add src/rocket_relations/ideal.py
((aste404) ivanbenitez@Mac-126 rocket-relations % git add tests/test_ideal.py
((aste404) ivanbenitez@Mac-126 rocket-relations % git commit -m "Add tests for c_star and c_f"
[main a1f394a] Add tests for c_star and c_f
 1 file changed, 18 insertions(+)
((aste404) ivanbenitez@Mac-126 rocket-relations % git push
Enumerating objects: 7, done.
Counting objects: 100% (7/7), done.
Delta compression using up to 12 threads
Compressing objects: 100% (3/3), done.
Writing objects: 100% (4/4), 525 bytes | 525.00 KiB/s, done.
Total 4 (delta 1), reused 0 (delta 0), pack-reused 0 (from 0)
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
remote: This repository moved. Please use the new location:
remote: https://github.com/iabenite-bot/rocket-relations.git
To https://github.com/iabenite-bot/Rocket-Relations.git
   4d0db2d..a1f394a  main -> main
((aste404) ivanbenitez@Mac-126 rocket-relations %
```

g) Part g also took some time but it was simple tying everything together in the README file.

```
test_ideal.py  README.md X
Users > ivanbenitez > rocket-relations > README.md > # rocket-relations > ## Tests
1  # rocket-relations
2
3  This is a python package that can be used for computing characteristic velocity (c_star) and thrust coefficient
   (c_f) under ideal rocket metrics and assumptions (Calorically perfect gas, isentropic flow, steady quasi-1D nozzle
   expansion, and choked throat conditions)
4
5  ## Installation
6
7  Create or activate your conda environment:
8
9  ```bash
10 conda create -n rocketenv python=3.14
11 conda activate rocketenv
12 pip install -e .
13 ```
14 After installing, run:
15
16 ```python
17 import rocket_relations
18 help(rocket_relations)
19 ```
20 ## Quickstart
21
22 ```python
23 from rocket_relations import c_star, c_f
24
25 # c*
26 gamma, R, T0 = 1.2, 350, 3500
27 print(c_star(gamma, R, T0)) # should be around 1706.6214
28
29 # C_F
30 gamma = 1.2
31 pe_p0, pa_p0, Ae_Astar = 0.0125, 0.02, 10
32 print(c_f(gamma, pe_p0, pa_p0, Ae_Astar)) # should be around 1.5423079
33 ```
34
35 ## Docs
36
37 Each function has a NumPy-stle docstring with types, units, and constraints
38
39 ```python
```

```
(aste404) ivanbenitez@Mac-126 rocket-relations % git add README.md
(aste404) ivanbenitez@Mac-126 rocket-relations % git commit -m "Add README with install, quickstart, docs, and test instructions"
[main 50ebcbb] Add README with install, quickstart, docs, and test instructions
1 file changed, 54 insertions(+)
(aste404) ivanbenitez@Mac-126 rocket-relations % git push
Enumerating objects: 5, done.
Counting objects: 100% (5/5), done.
Delta compression using up to 12 threads
Compressing objects: 100% (3/3), done.
Writing objects: 100% (3/3), 868 bytes | 868.00 KiB/s, done.
Total 3 (delta 1), reused 0 (delta 0), pack-reused 0 (from 0)
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
remote: This repository moved. Please use the new location:
remote:  https://github.com/iabenite-bot/rocket-relations.git
To https://github.com/iabenite-bot/Rocket-Relations.git
a1f394a..50ebcbb main -> main
(aste404) ivanbenitez@Mac-126 rocket-relations %
```

- h) Part h was very interesting and probably my favorite part of the assignment. It was something I've never done before so I had to do some research but I eventually was able to get everything documented via Sphinx.

🏠 rocket_relations

Search docs

CONTENTS:

rocket_relations package

API Reference

🏠 / Welcome to rocket_relations

[View page source](#)

Welcome to rocket_relations

This package provides formulas for evaluating ideal rocket flow relations, including characteristic velocity (c^*) and thrust coefficient (c_f) under calorically perfect gas and isentropic nozzle assumptions.

Contents:

- [rocket_relations package](#)
 - [Submodules](#)
 - [rocket_relations.ideal module](#)
 - [Module contents](#)
- [API Reference](#)

Usage Example

```
from rocket_relations import c_star, c_f

gamma = 1.2
R = 350
T0 = 3500

print(c_star(gamma, R, T0))
```

Next ➞

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