

```
PS C:\Users\Eliot Abramo\Documents\me\Reliability_Analysis> python main.py
```

```
=====  
RELIABILITY ANALYSIS STUDENT PROJECT  
=====
```

```
Welcome to the Reliability Analysis Tool!
```

```
This tool helps you analyze electronic component reliability using  
Monte Carlo simulation and sensitivity analysis methods.
```

```
i Checking environment setup...
```

```
✓ Python version: 3.14  
✓ Module 'numpy' found  
✓ Module 'pandas' found  
✓ Module 'matplotlib' found  
✓ Module 'math' found  
✓ Module 'openpyxl' found  
✓ File 'reliability_math.py' found  
✓ File 'task1_monte_carlo.py' found  
✓ File 'task2_sensitivity_analysis.py' found
```

```
=====  
RELIABILITY ANALYSIS - MAIN MENU  
=====
```

```
Please select an option:
```

1. Calculate Block Reliability (Deterministic)
2. Task 1: Monte Carlo Simulation
3. Task 2: Sensitivity Analysis
4. Run Both Tasks (Sequential)
5. Test Environment Setup
6. Help & Documentation
0. Exit

```
Your choice: 1
```

```
=====  
BLOCK RELIABILITY CALCULATION  
=====
```

```
i Please enter the path to your Excel data file:
```

```
(Press ENTER for default placement. Example: Reliability_Total.xlsx or ./data/Reliability_Total.xlsx)
```

```
File path: Reliability_Total.xlsx
```

```
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BLOCK RELIABILITY CALCULATION  
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(Press ENTER for default placement. Example: Reliability_Total.xlsx or ./data/Reliability_Total.xlsx)
```

```
File path: Reliability_Total.xlsx
```

```
✓ Excel file validated: Reliability_Total.xlsx
```

```
i Loading Excel file to list available blocks...
```

```
Available blocks (hierarchical structure):
```

```
/Project Architecture/Control/ (55 total components)
```

1. /Project Architecture/Control/ (10 components)
2. /Project Architecture/Control/MCU_A/ (15 components)
3. /Project Architecture/Control/MCU_B/ (15 components)
4. /Project Architecture/Control/MCU_C/ (15 components)

```
/Project Architecture/Power/ (307 total components)
```

5. /Project Architecture/Power/ (11 components)
6. /Project Architecture/Power/Battery Charger/ (62 components)
7. /Project Architecture/Power/Deploy/Boost/ (39 components)
8. /Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B1/ (9 components)
9. /Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B2/ (9 components)
10. /Project Architecture/Power/Deploy/Buck/ (17 components)
11. /Project Architecture/Power/Deploy/Buck/TRIGGER_LOGIC_B3/ (9 components)
12. /Project Architecture/Power/Ideal Diode Battery/ (5 components)

```
5. /Project Architecture/Power/ ( 11 components)
6.   /Project Architecture/Power/Battery Charger/ ( 62 components)
7.     /Project Architecture/Power/Deploy/Boost/ ( 39 components)
8.       /Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B1/ ( 9 components)
9.       /Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B2/ ( 9 components)
10.      /Project Architecture/Power/Deploy/Buck/ ( 17 components)
11.        /Project Architecture/Power/Deploy/Buck/TRIGGER_LOGIC_B3/ ( 9 components)
12.      /Project Architecture/Power/Ideal Diode Battery/ ( 5 components)
13.      /Project Architecture/Power/Ideal Diode Satellite/ ( 5 components)
14.      /Project Architecture/Power/LDO_3v3_bat/ ( 20 components)
15.      /Project Architecture/Power/LDO_3v3_sat/ ( 16 components)
16.      /Project Architecture/Power/Passivate Arbitration/ ( 9 components)
17.      /Project Architecture/Power/Passivate Memory/ ( 16 components)
18.      /Project Architecture/Power/Protection Battery/ ( 17 components)
19.      /Project Architecture/Power/Protection Satellite 24V/ ( 17 components)
20.      /Project Architecture/Power/System On Logic/ ( 3 components)
21.        /Project Architecture/Power/System On Logic/Off Arbitration/ ( 9 components)
22.        /Project Architecture/Power/System On Logic/On Arbitration/ ( 9 components)
23.        /Project Architecture/Power/System On Logic/On Memory/ ( 16 components)
24.      /Project Architecture/Power/Unlatch Arbitration/ ( 9 components)
```

/Project Architecture/Trigger IDD/ (9 total components)

```
25. /Project Architecture/Trigger IDD/ ( 9 components)
```

=====

i

Total: 25 blocks with 378 components

i

Enter block number or exact block name:

Tip: Start with a top-level block and use sub-block processing!

Block:

Process sub-blocks? (y/n): y

i Starting reliability calculation...

i Loading data from Reliability_Total.xlsx...

✓ Found 20 matching sheets:

- /Project Architecture/Power/
- /Project Architecture/Power/Battery Charger/
- /Project Architecture/Power/Deploy/Boost/
- /Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B1/
- /Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B2/
- /Project Architecture/Power/Deploy/Buck/
- /Project Architecture/Power/Deploy/Buck/TRIGGER_LOGIC_B3/
- /Project Architecture/Power/Ideal Diode Battery/
- /Project Architecture/Power/Ideal Diode Satellite/
- /Project Architecture/Power/LDO_3v3_bat/
- /Project Architecture/Power/LDO_3v3_sat/
- /Project Architecture/Power/Passivate Arbitration/
- /Project Architecture/Power/Passivate Memory/
- /Project Architecture/Power/Protection Battery/
- /Project Architecture/Power/Protection Satellite 24V/
- /Project Architecture/Power/System On Logic/
- /Project Architecture/Power/System On Logic/Off Arbitration/
- /Project Architecture/Power/System On Logic/On Arbitration/
- /Project Architecture/Power/System On Logic/On Memory/
- /Project Architecture/Power/Unlatch Arbitration/

Processing 20 blocks...

✓ All blocks processed

RELIABILITY ANALYSIS SUMMARY

Block	Comp	Lambda (FPH)	Reliability
/Project Architecture/Power/	11	1.911244e-07	0.991664
/Project Architecture/Power/Battery Charger/	62	1.196892e-06	0.948927
/Project Architecture/Power/Deploy/Boost/	39	5.414992e-07	0.976561
/Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B1/	9	5.369573e-08	0.997651
/Project Architecture/Power/Deploy/Boost/TRIGGER_LOGIC_B2/	9	5.369573e-08	0.997651
/Project Architecture/Power/Deploy/Buck/	17	2.749730e-07	0.988028
/Project Architecture/Power/Deploy/Buck/TRIGGER_LOGIC_B3/	9	5.369573e-08	0.997651
/Project Architecture/Power/Ideal Diode Battery/	5	1.325062e-07	0.994213
/Project Architecture/Power/Ideal Diode Satellite/	5	1.325062e-07	0.994213
/Project Architecture/Power/LDO_3v3_bat/	20	1.112744e-06	0.952430
/Project Architecture/Power/LDO_3v3_sat/	16	5.848157e-07	0.974710
/Project Architecture/Power/Passivate Arbitration/	9	5.369573e-08	0.997651
/Project Architecture/Power/Passivate Memory/	16	2.673851e-07	0.988357
/Project Architecture/Power/Protection Battery/	17	1.452035e-07	0.993660
/Project Architecture/Power/Protection Satellite 24V/	17	1.452035e-07	0.993660
/Project Architecture/Power/System On Logic/	3	4.467804e-08	0.998045
/Project Architecture/Power/System On Logic/Off Arbitration/	9	5.369573e-08	0.997651
/Project Architecture/Power/System On Logic/On Arbitration/	9	5.369573e-08	0.997651
/Project Architecture/Power/System On Logic/On Memory/	16	2.673851e-07	0.988357
/Project Architecture/Power/Unlatch Arbitration/	9	5.369573e-08	0.997651
SYSTEM TOTAL (Series)	307	5.412787e-06	0.788928

Mission Parameters:

Duration: 43,800 hours (5.00 years)

Cycles per year: 5,256

Temperature cycle amplitude: 3°C

Interpretation:

Green (R > 0.99) - Excellent reliability

Cyan (R > 0.95) - Good reliability

Yellow (R > 0.90) - Acceptable reliability

Red (R ≤ 0.90) - Poor reliability (needs attention)

✓

Calculation completed successfully!