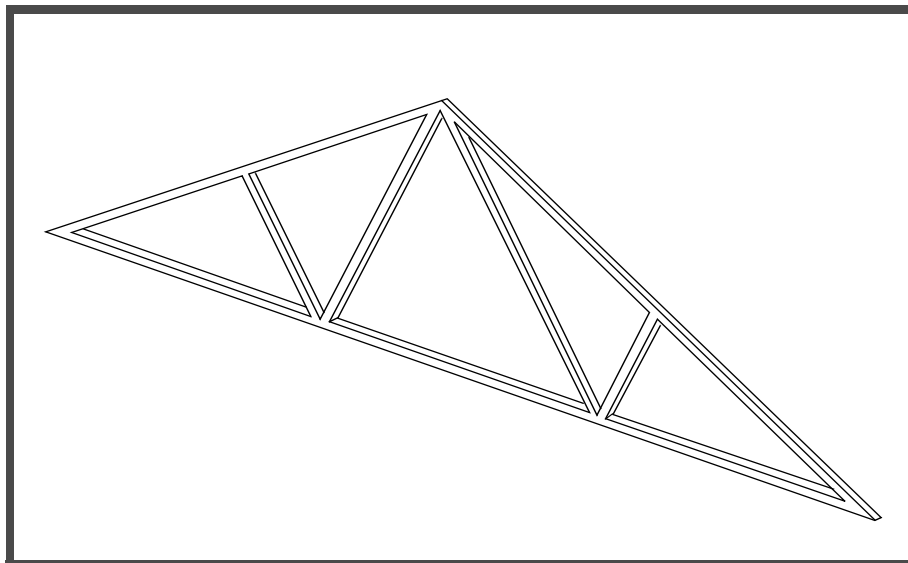


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## WORKSHOP 8

---

# *Results Combination Using Restart*



### Objectives:

- Using the model from **Workshop 2**, create two additional load cases for the truss using a combination of three previous load cases on a restart run.
- Restart an existing static analysis of a truss under these loading conditions.
- Review results.



**Model Description:**

This problem will be a restart of Problem 2. The solution will consist of two subcom's that will combine the results of the previous run.

The first subcom will be the sum of the first three subcases.

The second subcom will be the sum of the following:

$(1.0 \times \text{subcase 1}) + (2.0 \times \text{subcase 2}) + (1.5 \times \text{subcase 3})$

For each of the two combination cases -ONLY-, find the displacements and reaction forces for all grid locations, the element forces, stresses and margins of safety for all elements.

---

## Suggested Exercise Steps:

- Modify the MSC.Nastran input file to include the additional subcases which are summations of the results of previous subcases (SUBCOM).
- Specify the coefficients for forming a linear combination of the previous subcases (SUBSEQ).
- Request that data stores in a previous run be used in the current run (RESTART).
- Review results.







---

## Exercise Procedure:

1. Make a copy of the MSC.Nastran input file from exercise 2.
2. **MSC.Patran** users: in an available UNIX window, type:  
**cp prob2.bdf prob8.bdf**
3. **MSC.Nastran** users: in an available UNIX window, type:  
**cp prob2.dat prob8.dat**
4. First, delete **ALL** text lines above the line **SOL 101**, they are no longer needed.
  - 4a. Now insert the following line in the beginning of the file

```
RESTART VERSION=1,KEEP
```

5. Delete all output requests from SUBCASE 1, 2, and 3.
6. The text below defines the two SUBCOM's. Using a text editor, insert the SUBCOM definitions before the line **BEGIN BULK**.

```
SUBCOM 10
  LABEL = COMBINED LOADS
  SUBSEQ = 1.0, 1.0, 1.0
  TEMP(LOAD) = 2
  DISP = ALL
  FORCE = ALL
  STRESS = ALL
  SPCFORCE = ALL
SUBCOM 20
  LABEL = SCALED LOAD COMBINATIONS
  SUBSEQ = 1.0, 2.0, 1.5
  TEMP(LOAD) = 33
  DISP = ALL
  FORCE = ALL
  STRESS = ALL
  SPCFORCE = ALL
```

7. Since the entire Bulk Data is stored in the database, only the changes to the Bulk Data are required in the input file for a restart. Therefore, **DELETE** all existing Bulk Data Entries, between **BEGIN BULK** and **ENDDATA**.
8. In order to scale the temperature load, it will be necessary to change the temperature distribution for the temperature load (**see page 8-10 for a hint**). To redefine the temperature load for the scaled load combinations, insert the following text before the line **ENDDATA**.

```
TEMPD, 33, 54.0
TEMP, 33, 1, 31.5
```

TEMP,33,2,12.0  
TEMP,33,4,63.0  
TEMP,33,6,114.0  
TEMP,33,7,84.0

**Input File:**

```
RESTART VERSION=1,KEEP
ID SEMINAR,PROB8
TIME 5
SOL 101
CEND
TITLE = GARAGE ROOF FRAME
SUBTITLE = WOOD AND STEEL MEMBERS
    SPC = 20
SUBCASE 1
    LABEL = GRAVITY LOAD
    LOAD = 1
SUBCASE 2
    LABEL = TEMPERATURE
    TEMP(LOAD) = 2
SUBCASE 3
    LABEL = SNOW AND CONCENTRATED LOAD
    LOAD = 3
SUBCOM 10
    LABEL = COMBINED LOADS
    SUBSEQ = 1.0, 1.0, 1.0
    TEMP(LOAD) = 2
    DISP = ALL
    FORCE = ALL
    STRESS = ALL
    SPCFORCE = ALL
SUBCOM 20
    LABEL = SCALED LOAD COMBINATIONS
    SUBSEQ = 1.0, 2.0, 1.5
    TEMP(LOAD) = 33
    DISP = ALL
    FORCE = ALL
    STRESS = ALL
    SPCFORCE = ALL
BEGIN BULK
TEMPD,33,54.0
TEMP,33,1,31.5
TEMP,33,2,12.0
TEMP,33,4,63.0
TEMP,33,6,114.0
TEMP,33,7,84.0
ENDDATA
```

---

**HINT:**

**Determining the grid temperatures, sid=33 for Subcom 20**

*For example:*

**Calculate the temperature change in Subcase 3 at grid 1.**

$$\text{Temp (at grid 1)} = 45.0, \text{ Reference Temp} = 72.0$$

$$\Delta \text{ Temp} = 45.0 - 72.0 = -27.0$$

**Calculate the scaled temperature effect for the  $\Delta$  Temp.**

$$\text{Scale factor (subcom 20 for subcase 3)} = 1.5$$

$$\text{Scaled } \Delta \text{ Temp} = 1.5 \times -27.0 = -40.5$$

**Calculate the scaled temperature load at grid point 1.**

$$\text{Reference Temp} = 72.0, \text{ Scaled } \Delta \text{ Temp} = -40.5$$

$$\text{Scaled Temp load} = 72.0 + (-40.5) = 31.5$$

## Submitting the Input File for Analysis:

9. Make sure that the files prob2.DBALL and prob2.MASTER exist for the restart. If not, re-run the analysis for Problem 2.
  - 9a. To submit the MSC.Patran **.bdf** file for analysis, find an available UNIX shell window. At the command prompt enter: **nastran prob2.bdf**. Monitor the run using the UNIX **ps** command.
  - 9b. To submit the MSC.Nastran **.dat** file for analysis, find an available UNIX shell window. At the command prompt enter: **nastran prob2.dat**. Monitor the run using the UNIX **ps** command.
10. Submit the input file to MSC.Nastran for analysis.
  - 10a. To submit the MSC.Patran **.bdf** file for analysis, find an available UNIX shell window. At the command prompt enter: **nastran prob8.bdf dbs=prob2**. Monitor the run using the UNIX **ps** command.
  - 10b. To submit the MSC.Nastran **.dat** file for analysis, find an available UNIX shell window. At the command prompt enter: **nastran prob8.dat dbs=prob2**. Monitor the run using the UNIX **ps** command.
11. When the run is completed, edit the **prob8.f06** file and search for the word **FATAL**. If no matches exist, search for the word **WARNING**. Determine whether existing **WARNING** messages indicate modeling errors.
  - 11a. While still editing **prob8.f06**, search for the word:

**D I S P L A C E** (spaces are necessary).

What are the components of the displacement vector for GRID 1, 3, and 5 (translation only)?:

Combined Load Case	Scaled Load Combinations
Grid 1	Grid 1
Disp. X = _____	Disp. X = _____
Disp. Y = _____	Disp. Y = _____
Disp. Z = _____	Disp. Z = _____
Grid 3	Grid 3
Disp. X = _____	Disp. X = _____

---

Disp. Y = _____ Disp. Z = _____ Grid 5 Disp. X = _____ Disp. Y = _____ Disp. Z = _____	Disp. Y = _____ Disp. Z = _____ Grid 5 Disp. X = _____ Disp. Y = _____ Disp. Z = _____
---	---

**Search for the word:**

**S I N G L E** (spaces are necessary).

What are the components of the reaction force at GRID 1 and GRID 7?

Combined Load Case	Scaled Load Combinations
GRID 1	GRID 1
T1 = _____	T1 = _____
T2 = _____	T2 = _____
T3 = _____	T3 = _____
GRID 7	GRID 7
T1 = _____	T1 = _____
T2 = _____	T2 = _____
T3 = _____	T3 = _____

Search for the word:

**F O R C E D I S T** (spaces are necessary).

What is the axial force in the BAR elements, (CBAR)?

Combined Load Case	Scaled Load Combinations
Element 4	Element 4
PCT 1.000 _____	PCT 1.000 _____
PCT 0.000 _____	PCT 0.000 _____

Element 11	Element 11
PCT 1.000 _____	PCT 1.000 _____
PCT 0.000 _____	PCT 0.000 _____

What is the axial force in CROD elements 7 and 8?

<b>Combined Load Case</b>	<b>Scaled Load Combinations</b>
Element 7 _____	Element 7 _____
Element 8 _____	Element 8 _____

Search for the word:

**S T R E S S** (spaces are necessary).

What is the margin of safety for elements 6 and 11?

<b>Combined Load Case</b>	<b>Scaled Load Combinations</b>
Element 6	Element 6
PCT 1.000 _____	PCT 1.000 _____
PCT 0.000 _____	PCT 0.000 _____
Element 11	Element 11
PCT 1.000 _____	PCT 1.000 _____
PCT 0.000 _____	PCT 0.000 _____

What is the Axial Stress for all elements 6 and 11?

<b>Combined Load Case</b>	<b>Scaled Load Combinations</b>
Element 6	Element 6
PCT 1.000 _____	PCT 1.000 _____
PCT 0.000 _____	PCT 0.000 _____
Element 11	Element 11
PCT 1.000 _____	PCT 1.000 _____

---

PCT 0.000

PCT 0.000

**Comparison of Results:**

12. Compare the results obtained in the **.f06** file with the results below.

**COMBINED LOADS**

POINT ID.	TYPE	D I S P L A C E M E N T V E C T O R					
		T1	T2	T3	R1	R2	R3
1	G	0.0	0.0	0.0	0.0	0.0	-5.915849E-03
2	G	1.071794E-01	-3.381076E-01	0.0	0.0	0.0	2.544115E-03
3	G	-8.569690E-03	-3.316230E-01	0.0	0.0	0.0	1.548285E-04
4	G	-6.612658E-02	-8.022887E-02	0.0	0.0	0.0	1.870617E-03
5	G	-1.656732E-02	-6.795923E-02	0.0	0.0	0.0	1.394551E-03
6	G	-4.515067E-02	-4.489013E-02	0.0	0.0	0.0	-3.918693E-05
7	G	-1.096685E-02	0.0	0.0	0.0	0.0	9.692505E-05

**SCALED LOAD COMBINATIONS**

POINT ID.	TYPE	D I S P L A C E M E N T V E C T O R					
		T1	T2	T3	R1	R2	R3
1	G	0.0	0.0	0.0	0.0	0.0	-8.865292E-03
2	G	1.416618E-01	-5.078505E-01	0.0	0.0	0.0	3.890638E-03
3	G	-2.634441E-02	-4.915359E-01	0.0	0.0	0.0	3.416293E-04
4	G	-1.370600E-01	-1.097557E-01	0.0	0.0	0.0	2.991944E-03
5	G	-4.667113E-02	-7.261032E-02	0.0	0.0	0.0	2.102673E-03
6	G	-8.816119E-02	-3.688439E-02	0.0	0.0	0.0	-5.870433E-05
7	G	-4.026162E-02	0.0	0.0	0.0	0.0	-1.006498E-04

COMBINED LOADS

POINT ID.	TYPE	T1	T2	T3	R1	R2	R3
1	G	1.165000E-04	1.427116E+04	0.0	0.0	0.0	0.0
7	G	0.0	4.254492E+03	0.0	0.0	0.0	0.0

SCALED LOAD COMBINATIONS

POINT ID.	TYPE	T1	T2	T3	R1	R2	R3
1	G	1.747500E-04	2.087533E+04	0.0	0.0	0.0	0.0
7	G	0.0	5.850326E+03	0.0	0.0	0.0	0.0

**COMBINED LOADS**

0		F O R C E D I S T R I B U T I O N I N B A R E L E M E N T S ( C B A R )											
E L E M E N T I D .	S T A T I O N ( P C T )	B E N D - M O M E N T		S H E A R F O R C E		P L A N E 1		P L A N E 2		A X I A L F O R C E		T O R Q U E	
		P L A N E 1	P L A N E 2	P L A N E 1	P L A N E 2	P L A N E 1	P L A N E 2	P L A N E 1	P L A N E 2	P L A N E 1	P L A N E 2	P L A N E 1	P L A N E 2
1	0.000	-1.101318E+05	0.0	-5.653981E+03	0.0	-2.128362E+04	0.0	-2.128362E+04	0.0	-2.128362E+04	0.0	-2.128362E+04	0.0
1	1.000	-6.385827E+04	0.0	4.005832E+03	0.0	-1.645372E+04	0.0	-1.645372E+04	0.0	-1.645372E+04	0.0	-1.645372E+04	0.0
2	0.000	-6.385827E+04	0.0	-2.361120E+03	0.0	-1.551464E+04	0.0	-1.551464E+04	0.0	-1.551464E+04	0.0	-1.551464E+04	0.0
2	1.000	-2.932529E+04	0.0	8.588179E+02	0.0	-1.390467E+04	0.0	-1.390467E+04	0.0	-1.390467E+04	0.0	-1.390467E+04	0.0
3	0.000	-2.932529E+04	0.0	-2.448169E+02	0.0	-8.965545E+03	0.0	-8.965545E+03	0.0	-8.965545E+03	0.0	-8.965545E+03	0.0
3	1.000	1.008947E+04	0.0	-2.448169E+02	0.0	-8.965545E+03	0.0	-8.965545E+03	0.0	-8.965545E+03	0.0	-8.965545E+03	0.0
4	0.000	1.008947E+04	0.0	1.168222E+02	0.0	-9.063545E+03	0.0	-9.063545E+03	0.0	-9.063545E+03	0.0	-9.063545E+03	0.0
4	1.000	-8.718536E+03	0.0	1.168222E+02	0.0	-9.063545E+03	0.0	-9.063545E+03	0.0	-9.063545E+03	0.0	-9.063545E+03	0.0
9	0.000	1.101318E+05	0.0	6.071592E+02	0.0	1.650811E+04	0.0	1.650811E+04	0.0	1.650811E+04	0.0	1.650811E+04	0.0
9	1.000	-6.442806E+03	0.0	6.071592E+02	0.0	1.650811E+04	0.0	1.650811E+04	0.0	1.650811E+04	0.0	1.650811E+04	0.0
10	0.000	-6.442801E+03	0.0	-1.497711E+03	0.0	7.484518E+03	0.0	7.484518E+03	0.0	7.484518E+03	0.0	7.484518E+03	0.0
10	1.000	-3.088237E+04	0.0	5.022894E+02	0.0	8.054436E+03	0.0	8.054436E+03	0.0	8.054436E+03	0.0	8.054436E+03	0.0
11	0.000	-3.088237E+04	0.0	-2.062547E+02	0.0	8.054436E+03	0.0	8.054436E+03	0.0	8.054436E+03	0.0	8.054436E+03	0.0
11	1.000	8.718536E+03	0.0	-2.062547E+02	0.0	8.054436E+03	0.0	8.054436E+03	0.0	8.054436E+03	0.0	8.054436E+03	0.0

0		F O R C E S I N R O D E L E M E N T S ( C R O D )			
E L E M E N T I D .	S T A T I O N ( P C T )	A X I A L F O R C E		T O R Q U E	
		P L A N E 1	P L A N E 2	P L A N E 1	P L A N E 2
5	0.000	-6.647411E+03	0.0	9.620107E+03	0.0
7	0.000	1.160979E+03	0.0	1.335437E+02	0.0

SCALED LOAD COMBINATIONS

ELEMENT ID.	STATION (PCT)	FORCE DISTRIBUTION IN BAR ELEMENTS ( C B A R )		SHEAR FORCE		AXIAL FORCE		TORQUE
		PLANE 1	PLANE 2	PLANE 1	PLANE 2	FORCE	TORQUE	
1	0.000	-1.646336E+05	0.0	-8.478093E+03	0.0	-4.916200E+04	0.0	0.0
1	1.000	-9.568688E+04	0.0	6.011627E+03	0.0	-4.191714E+04	0.0	0.0
2	0.000	-9.568688E+04	0.0	-3.547410E+03	0.0	-3.490165E+04	0.0	0.0
2	1.000	-4.296488E+04	0.0	1.282497E+03	0.0	-3.248670E+04	0.0	0.0
3	0.000	-4.296488E+04	0.0	-3.428836E+02	0.0	-6.799488E+03	0.0	0.0
3	1.000	1.223832E+04	0.0	-3.428836E+02	0.0	-6.799488E+03	0.0	0.0
4	0.000	1.223832E+04	0.0	1.546559E+02	0.0	-3.095565E+03	0.0	0.0
4	1.000	-1.266080E+04	0.0	1.546559E+02	0.0	-3.095565E+03	0.0	0.0
9	0.000	1.646336E+05	0.0	8.958865E+02	0.0	1.151820E+04	0.0	0.0
9	1.000	-7.376643E+03	0.0	8.958865E+02	0.0	1.151820E+04	0.0	0.0
10	0.000	-7.376637E+03	0.0	-2.213971E+03	0.0	3.048369E+03	0.0	0.0
10	1.000	-5.029421E+04	0.0	7.860291E+02	0.0	3.048369E+03	0.0	0.0
11	0.000	-5.029421E+04	0.0	-3.278907E+02	0.0	1.012675E+04	0.0	0.0
11	1.000	1.266080E+04	0.0	-3.278907E+02	0.0	1.012675E+04	0.0	0.0

ELEMENT ID.	FORCES IN ROD ELEMENTS ( C R O D )		ELEMENT ID.	AXIAL FORCE		TORQUE
	AXIAL FORCE	TORQUE		FORCE	TORQUE	
5	-1.022127E+04	0.0	6	1.392133E+04	0.0	
7	1.387669E+03	0.0	8	3.803258E+02	0.0	

COMBINED LOADS

ELEMENT ID.	STATION (PCT)	STRESS DISTRIBUTION IN BAR ELEMENTS (C B A R)			S-MIN	S-MAX	M.S.-T		
		SXC	SXD	SXE				SXF	AXIAL
1	0.000	1.181742E+04	-1.181742E+04	-1.181742E+04	1.181742E+04	-3.869750E+03	7.947666E+03	-1.568717E+04	5.3E-01
1	1.000	6.852154E+03	-6.852154E+03	-6.852154E+03	6.852154E+03	-2.991585E+03	3.860569E+03	-9.843739E+03	1.4E+00
2	0.000	6.852154E+03	-6.852154E+03	-6.852154E+03	6.852154E+03	-2.820844E+03	4.031310E+03	-9.672998E+03	1.5E+00
2	1.000	3.146677E+03	-3.146677E+03	-3.146677E+03	3.146677E+03	-2.528123E+03	6.185547E+02	-5.674800E+03	3.2E+00
3	0.000	3.146678E+03	-3.146678E+03	-3.146678E+03	3.146678E+03	-1.630099E+03	1.516579E+03	-4.776777E+03	1.5E+01
3	1.000	-1.082626E+03	1.082626E+03	1.082626E+03	-1.082626E+03	-1.630099E+03	-5.474730E+02	-2.712725E+03	4.0E+00
4	0.000	-1.082626E+03	1.082626E+03	1.082626E+03	-1.082626E+03	-1.647917E+03	-5.652291E+02	-2.730543E+03	7.8E+00
4	1.000	9.355210E+02	-9.355210E+02	-9.355210E+02	9.355210E+02	-1.647917E+03	-7.123396E+02	-2.583438E+03	1.3E+00
9	0.000	-7.791193E+03	7.791193E+03	7.791193E+03	-7.791193E+03	2.539710E+03	1.033090E+04	-5.251483E+03	1.3E+00
9	1.000	4.557917E+02	-4.557917E+02	-4.557917E+02	4.557917E+02	2.539710E+03	2.995501E+03	2.083918E+03	3.6E+00
10	0.000	4.557914E+02	-4.557914E+02	-4.557914E+02	4.557914E+02	1.151464E+03	1.607256E+03	6.956730E+02	1.4E+01
10	1.000	2.184751E+03	-2.184751E+03	-2.184751E+03	2.184751E+03	1.151464E+03	3.336216E+03	-1.033287E+03	6.2E+00
11	0.000	2.184751E+03	-2.184751E+03	-2.184751E+03	2.184751E+03	1.239144E+03	3.423895E+03	-9.456072E+02	6.0E+00
11	1.000	-6.167866E+02	6.167866E+02	6.167866E+02	-6.167866E+02	1.239144E+03	1.855931E+03	6.223574E+02	2.4E+01

ELEMENT ID.	STRESS IN ROD ELEMENTS (C R O D)			AXIAL STRESS	SAFETY MARGIN	TORSIONAL STRESS	SAFETY MARGIN
	AXIAL STRESS	TORSIONAL STRESS	SAFETY MARGIN				
5	-1.278348E+03	0.0	4.9E-01	6	1.850021E+03	2.7E-02	0.0
7	2.232651E+02	0.0	7.5E+00	8	2.568148E+01	7.3E+01	0.0

SCALED LOAD COMBINATIONS

ELEMENT ID.	STATION (PCT)	STRESS DISTRIBUTION IN BAR ELEMENTS (C B A R)				M.S.-T	M.S.-C	
		SXD	SXE	SXF	S-MIN			
ELEMENT ID.	STATION (PCT)	STRESSES IN ROD ELEMENTS (C R O D)				TORSTONAL STRESS	SAFETY MARGIN	
		AXIAL STRESS	TORSTONAL STRESS	SAFETY MARGIN	AXIAL STRESS			
1	0.000	1.766560E+04	-1.766560E+04	1.766560E+04	-8.938545E+03	8.727053E+03	-2.660414E+04	-9.8E-02
1	1.000	1.026744E+04	-1.026744E+04	1.026744E+04	-7.621297E+03	2.646146E+03	-1.788874E+04	3.4E-01
2	0.000	1.026745E+04	-1.026745E+04	1.026745E+04	-6.345754E+03	3.921691E+03	-1.661320E+04	4.4E-01
2	1.000	4.610240E+03	-4.610240E+03	4.610240E+03	-5.906672E+03	-1.296432E+03	-1.051691E+04	1.3E+00
3	0.000	4.610240E+03	-4.610240E+03	4.610240E+03	-1.236271E+03	3.373969E+03	-5.846510E+03	6.1E+00
3	1.000	-1.313203E+03	1.313203E+03	-1.313203E+03	-1.236271E+03	7.693250E+01	-2.549474E+03	3.1E+00
4	0.000	-1.313203E+03	1.313203E+03	-1.313203E+03	-5.628300E+02	7.503730E+02	-1.876033E+03	2.9E+01
4	1.000	1.358536E+03	-1.358536E+03	1.358536E+03	-5.628300E+02	7.957062E+02	-1.921366E+03	1.1E+01
9	0.000	-1.164688E+04	1.164688E+04	-1.164688E+04	1.772031E+03	1.341892E+04	-9.874853E+03	7.9E-01
9	1.000	5.218553E+02	-5.218553E+02	5.218553E+02	1.772031E+03	2.293887E+03	1.250176E+03	1.4E+00
10	0.000	5.218549E+02	-5.218549E+02	5.218549E+02	4.689798E+02	9.908347E+02	-5.287512E+01	2.3E+01
10	1.000	3.558028E+03	-3.558028E+03	3.558028E+03	4.689798E+02	4.027008E+03	-3.089049E+03	5.0E+00
11	0.000	3.558028E+03	-3.558028E+03	3.558028E+03	1.557961E+03	5.115989E+03	-2.000067E+03	3.7E+00
11	1.000	-8.956794E+02	8.956794E+02	-8.956794E+02	1.557961E+03	2.453640E+03	6.622816E+02	1.1E+01

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**13. End of Exercise.**