SPINOFFS

Spinoffs are relatively short learning modules inspired by the LTAs. They can be easily implemented to support student learning in courses ranging from prealgebra through calculus. The Spinoffs typically give students an opportunity to use mathematics in a real world context.

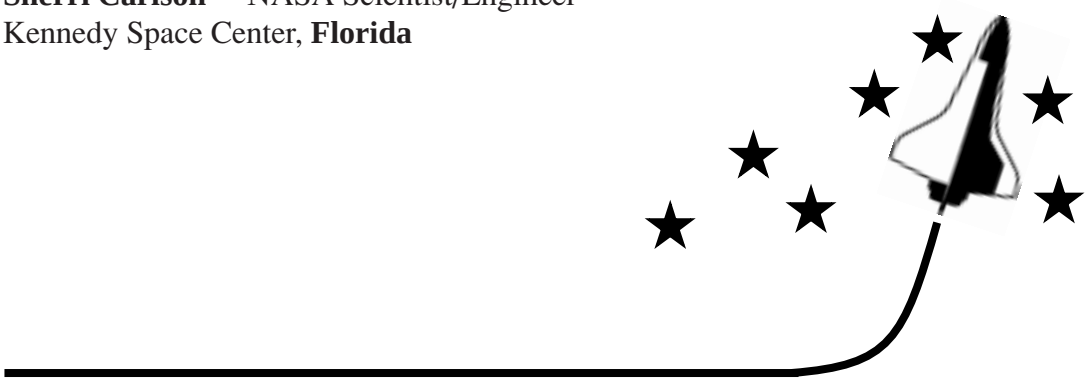
LTA - SPINOFF 17A — The Internal Thermal Control System in the United States Lab

LTA - SPINOFF 17B — Simulations to Test the Electrical Power System

Chris Oehrlein - AMATYC Writing Team Member
Oklahoma City Community College, Oklahoma City, **Oklahoma**

Pete Wildman - AMATYC Writing Team Member
Casper College, Casper, **Wyoming**

Sherri Carlson - NASA Scientist/Engineer
Kennedy Space Center, **Florida**



Project Grant Team

John S. Pazdar
Project Director
Capital Community College
Hartford, Connecticut

Patricia L. Hirschy
Principal Investigator
Asnuntuck Community College
Enfield, Connecticut

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Peter A. Wursthorn
Principal Investigator
Capital Community College
Hartford, Connecticut

SPINOFF 17B

Simulations to Test the Electrical Power System

In this Spinoff, we will simulate the test of the Electrical Power System (EPS) in the United States lab, a component of the International Space Station. You can generate sample data for the simulation using a graphing calculator or computer. The second part of the Spinoff provides programs for generating data either using various Texas Instruments graphing calculators or using Derive for Windows™.

Part A The Simulation Process

1) Refer back to Test 1: Electrical Power System (EPS). Recall the individual statements and the compound statement. Reconstruct the truth table for the compound statement.

2) Use a program for your computer/calculator (some are provided in the appendices) to generate sample data for a simulated test of the EPS. If you are not using a computer or calculator, your instructor will provide this sample data for you.
   a) What is your raw data?
   b) What does this data represent in terms of the statements for the test?
   c) According to this data and the truth table, does the EPS pass or fail the system test? Why?
   d) Why would the voltage and current readings be zero (0) when both the laptop on the Shuttle Orbitor and the computer at JSC receive "no response" from the EPS?

3) Repeat the simulation in Exercise 2 an additional 59 times. Keep track of all of the raw data. Round all percents to the nearest tenth of a percent.
   a) Determine the following percents.
      What percent of the time is there a response to the laptop?
      What percent of the time is there a response to JSC?
      What percent of the time is there a response to both the laptop and the JSC?
      What percent of the time is there no response to either the laptop or the JSC?
   b) Draw a Venn Diagram to represent the 60 tests. Be sure to clearly define the sets and what they represent. Describe the percents from Exercise 3a in terms of sets.
   c) Use only those test simulations in which at least one of the computers received a response. What percent of the time were both the voltage and current readings acceptable?
   d) Use all the test simulations. What percent of the time did the EPS system pass the test?
   e) If these simulations were the actual tests of the EPS initialization process, how would you feel about its reliability? Why?

Part B Simulation Programs for Selected Graphing Calculators and Computer Software

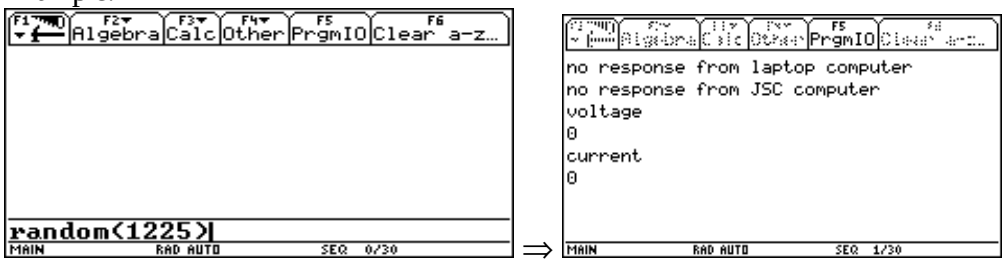
In order to complete Part 1 of this Spinoff you will need a graphing calculator or computer software program. Following are programs for Derive for Windows™ and for TI-92™, TI-83™, TI-82™, TI-85™ and TI-86™.

TI-92™

```
Random (y)
Prgm
ClrIO
RandSeed y
rand(2)-1→x
rand(2)-1→z
rand()*500→volt
rand()*5→current
If x=0 Then
Disp "no response from laptop computer"
Else
Disp "laptop computer has responded"
EndIf
If z=0 Then
Disp "no response from JSC computer"
Else
Disp "JSC computer has responded"
EndIf
If x=0 and z=0 Then
Disp "voltage",0
Disp "current",0
Else
Disp "voltage",volt
Disp "current",current
EndIf
EndPrgm
```

INSTRUCTIONS FOR USE: To use the random program you must provide the program with a seed. The seed may be any positive integer.

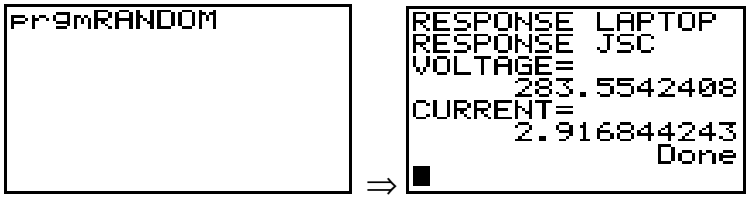
Example:



```
ClrHome
randInt(0,1)→X
randInt(0,1)→Y
If X=1
Then
Disp "RESPONSE LAPTOP"
Else
Disp "NO RESPONSE LAPTOP"
End
If Y=1
Then
Disp "RESPONSE JSC"
Else
Disp "NO RESPONSE JSC"
End
If ((X=0) and (Y=0))
Then
Disp "VOLTAGE = ",0
Disp "CURRENT = ",0
Else
rand*500→V
rand*5→C
Disp "VOLTAGE=",V
Disp "CURRENT=",C
End
```

INSTRUCTIONS FOR USE: Hit PRGM and select RANDOM, hit enter twice

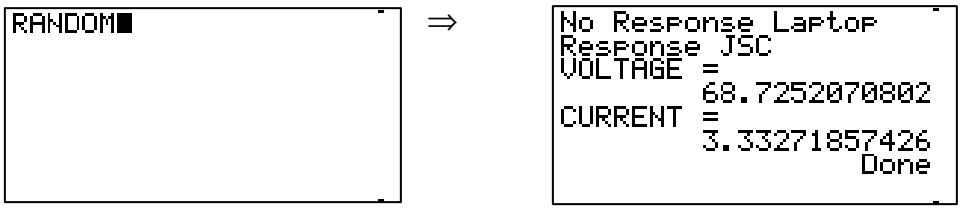
Example:



```
ClLCD
iPart (rand(2)) → X
iPart (rand(2)) → Y
If X=1
Then
Disp "Response Laptop"
Else
Disp "No Response Laptop"
End
If Y=1
Then
Disp "Response JSC"
Else
Disp "No Response JSC"
End
If ((X=0) and (Y=0))
Then
Disp "VOLTAGE = ",0
Disp "CURRENT = ",0
Else
rand*500→V
rand*5→C
Disp "VOLTAGE = ",V
Disp "CURRENT = ",C
End
```

INSTRUCTIONS FOR USE: Hit PRGM and select NAMES, find the RANDOM program (hit MORE if necessary) select the appropriate F key and hit enter.

Example:



Following is a copy of the algebra screen from Derive for Windows™ after executing the practice problems:

```
[VIEW]
State=1
Position=22 22 642 327
[Algebra Options]
TextBGColor=16777215
TextColor=0
HighlightTextBGColor=8388608
HighlightTextColor=16777215
[Algebra State Variables]
Precision=Exact
PrecisionDigits=6
Notation=Rational
NotationDigits=6
Branch=Principal
Exponential=Auto
Logarithm=Auto
Trigonometry=Auto
Trigpower=Auto
Angle=Radian
CaseMode=Insensitive
VariableOrder=[x,y,z]
OutputBase=10
InputBase=10
jInputMode=Character
DisplayFormat=Normal
TimesOperator=Dot
[PrintFont]
Height=0
[Algebra Print Options]
Annotations=Yes
Labels=Yes
ComputationTime=Yes
[Plot Print Options]
HeaderFooter=Yes
CenteredPlot=Yes
B&WOnly=Yes
[PageSetup]
HeaderLeft=File: &f
HeaderCenter=Date: &d
HeaderRight=Time: &t
FooterLeft=
FooterCenter=Page: &p
FooterRight=
Margins=1.00 1.00 1.00 1.00 0.50 0.50
[Algebra Save Options]
SaveExpressions=Yes
SaveStateVariables=No
MakeBackup=No
[FRAME]
Position=-4 -4 808 580
State=0
[Recent File List]
File1=Z:\wursthorn\ME2ORIG\LTA17\exercise4.mth
```