SIEMENS POWER SYSTEM SIMULATION FOR ENGINEERS® (PSS/E)

LAB4
MANUAL CREATION OF *.CON, *.MON, AND *.SUB FILES

Power Systems Simulations
Colorado State University

Purpose of the lab:
This lab guides the user to create the *.con, *.mon, and *.sub files manually based on the completion of lab 3 and using these files sample.sav and sample.sld. Also, giving the user a deeper understanding of how to create and modify the three files which are necessary to perform the ACCC analysis for PF. Objectives of the lab:

- Create & Modify subsystem file (*.sub)
- Create & Modify monitor file (*.mon)
- Create & Modify contingency file (*.con)
- Apply ACCC using the files above.
- ACCC report.

A Text file "*.txt" is necessary to get familiar with Text files to do this lab. A text file (or plain text file) is a file which contains only ordinary textual characters with essentially no formatting. Text files are commonly used throughout **PSS®E** because soft code contains commands often needed to complete tasks. **PSS®E** utilizes specifically named .txt files to perform ACCC analysis. These files are named *.sub, *.mon and *.com (subsystem, monitor and contingency files respectively)

Recap of some important definitions:

·   ***.sub (subsystem) file:**
The subsystem file informs the power flow analysis to only look at a prescribed section, or zone, of the overall network.
·   ***.mon (monitor) file:**
The monitor file tells the power flow simulator which branches to be supervised during the (N-1) contingencies
·   ***.con (contingency) file:**
The contingency file is programmed to remove equipment, one piece at a time from service; this is referred to as a contingency. When the system is fully operational, it has no outages, and it is referred to as system intact or (N-0). When a single line is taken out of service, the case is then referred to as an (N-1). The easiest way to program how to do this is to see a portion of the code used in the *.con file and understand what everything does.
·   **ACCC**
The contingency, monitor, and subsystem files are utilized by the AC Contingency Calculation (ACCC) feature of PSS/E to perform a power flow study on a prescribed zone. The ACCC produces power flow analysis of a system.
·   **DFAX (distribution factors file):**
It is a measure of the impact of injections and network changes on the grid applied over the initial or base case power flow. DFAX represents a measure of the effect of each zone's load on

the transmission constraint that requires the mitigating upgrade, as determined by power flow analysis. The source used for the DFAX calculation is the aggregate of all generation external to the study area.
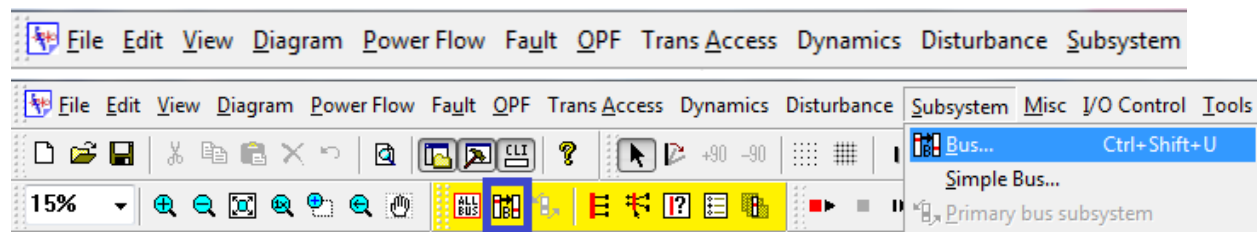
· **Areas:**

Graphically, an Area typically represents an entire region, perhaps a state (Colorado) or small country (Bahrain). Areas can be utilized to represent a regional electric market.ie; the majority of load within an area is served with the majority of generation in that same area. Load can be served with generation from another area. This is typically accomplished thru metering and schedules but is outside the scope of this lab. The only reason for a detailed explanation is to present this concept and Bulk Electric System (BES) structural philosophy currently practiced in the real world to familiarize the future power engineer.

➕ **The following steps are to help the user write the *.sub,*.mon, and *.con files manually for a modified area called "area1a" Using "central_1a" subsystem:**

1. Start **PSS®E** as it was shown in lab1.
2. Open the sample.sav file from your PSSE Labs folder as it was shown in lab1.
3. Open the sample.sld file from your PSSE Labs folder as it was shown in lab1.
4. Create a new folder in your PSSE Labs folder and name it "Lab4"
5. Once both files are opened, Go to toolbar and click on Subsystem.

Or use the shortcut icon ▦

6. Select Bus ▦, then select *central* area and click on arrow ⊳ to selected areas box as shown below
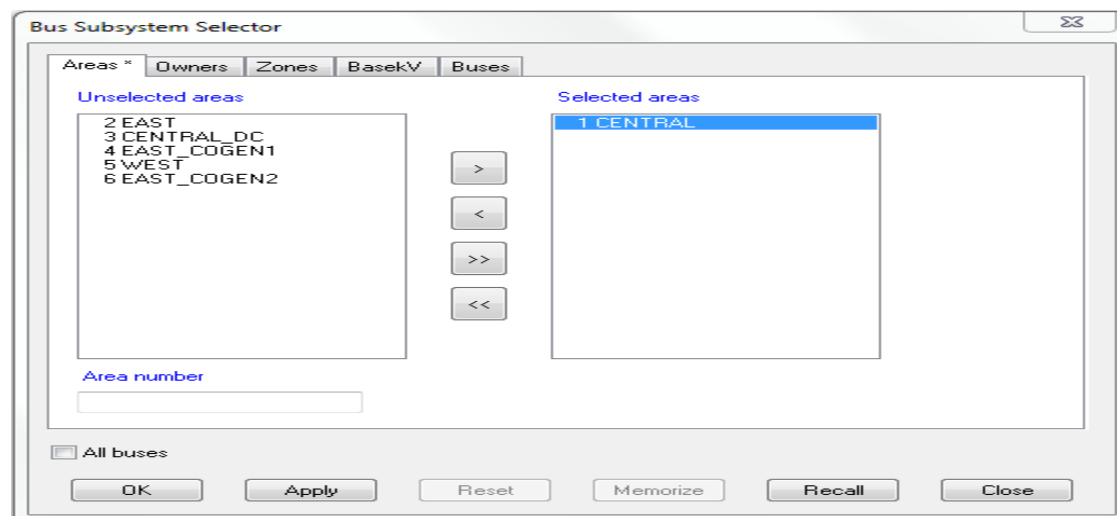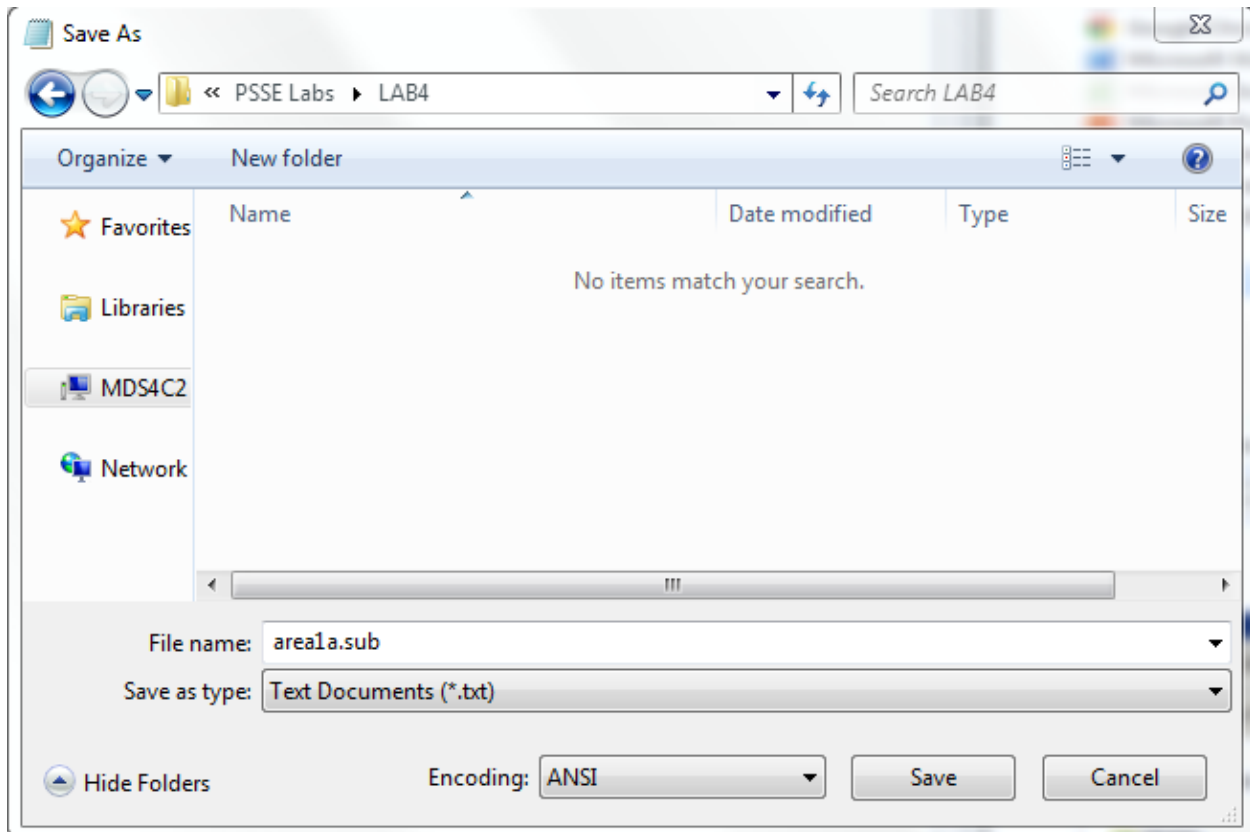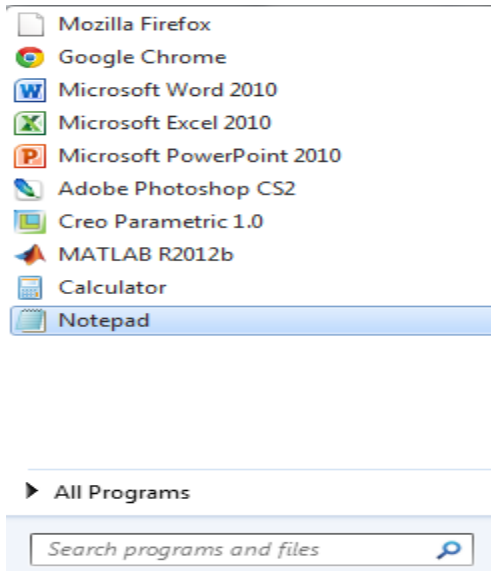
7. Click Apply and Ok to close the Bus Subsystem Selector window.

8. Go to sample.sav window and check you have Central area buses, branches ….etc. only.
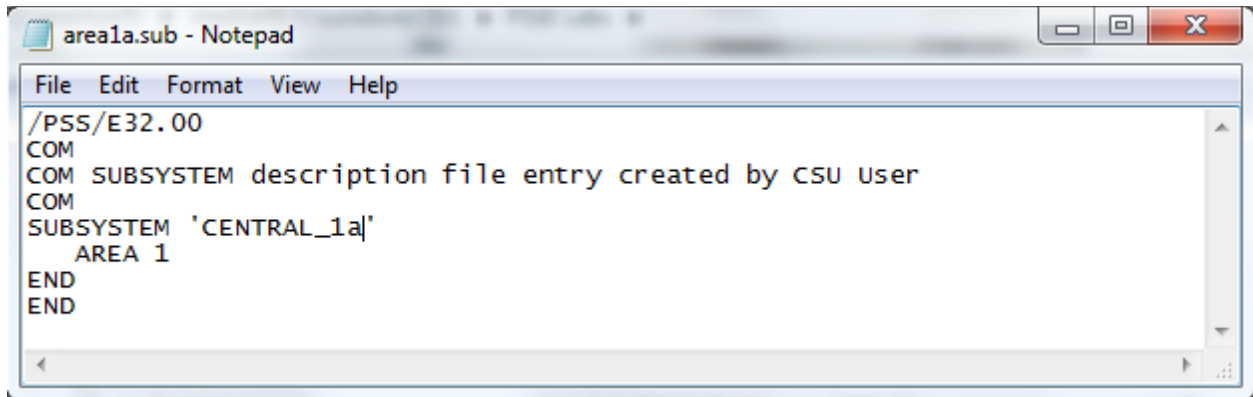
Notepad:

❖ *Subsystem file (*.sub):*

1. Now open the Notepad program. Save As and Name it "area1a.sub" in the file name blank in "Lab4" folder.

Mozilla Firefox
Google Chrome
Microsoft Word 2010
Microsoft Excel 2010
Microsoft PowerPoint 2010
Adobe Photoshop CS2
Creo Parametric 1.0
MATLAB R2012b
Calculator
Notepad

▶ All Programs

Search programs and files

Save As

« PSSE Labs ▶ LAB4   Search LAB4

Organize ▼   New folder

Favorites   Name   Date modified   Type   Size

Libraries   No items match your search.

MDS4C2

Network

File name: area1a.sub

Save as type: Text Documents (*.txt)

Hide Folders   Encoding: ANSI   Save   Cancel

2. It is time to start typing the text showing in the picture bellow:

** *Make sure file is identical to the file above; otherwise it may not run properly.*

3. Save and close *area1a.sub*

❖ *Monitor file (*.mon):*
1. Now open the Notepad program. Save As and Name it "area1a.mon" in the file name blank in "Lab4" folder.
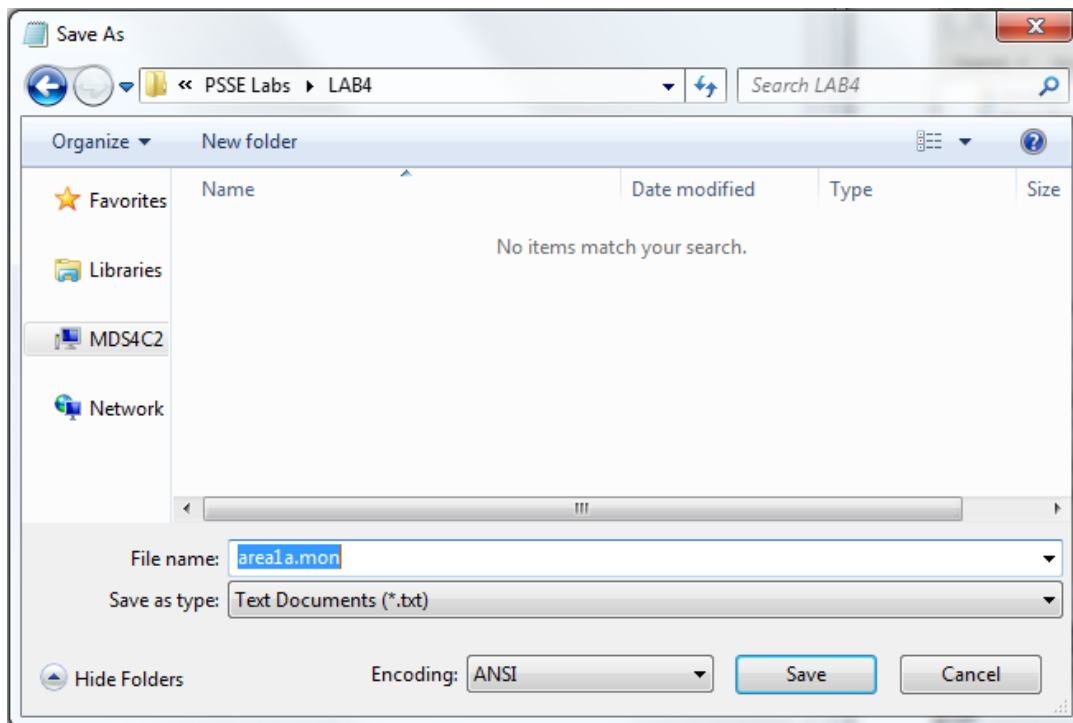
2. Create and type *area1a.mon* with exact command shown next page:

area1a.mon - Notepad

```
/PSS/E32.00
COM
COM MONITORED element file entry created by CSU User
COM
MONITOR VOLTAGE RANGE SUBSYSTEM 'CENTRAL_1a' 0.9500 1.050
MONITOR VOLTAGE DEVIATION SUBSYSTEM 'CENTRAL_1a' 0.050 0.065
MONITOR BRANCHES IN SUBSYSTEM 'CENTRAL_1a'
END
```

** Make sure file is identical to the file above; otherwise it may not run properly.

* In the monitor file you can determine the voltage range of a subsystem so no monitored elements exceed a specified range (V-Max, V-Min) of a specified subsystem. All voltage-controlled buses in specified base voltage range will be including in your contingency plan.

3. Save and close *area1a.sub*

❖ *Contingency file (*.con):*

1. Go to Sample.sav. Click on `Branch` tab.

From Bus Number	From Bus Name		To Bus Number	To Bus Name		Id	Line R (pu)	Line X (pu)	Charging (pu)	In Service
151	NUCPLNT	500.00	152	MID500	500.00	1	0.002600	0.046000	3.500000	✓
151	NUCPLNT	500.00	152	MID500	500.00	2	0.002610	0.046100	3.510000	✓
151	NUCPLNT	500.00	201	HYDRO	500.00	1	0.001000	0.015000	1.200000	✓
152	MID500	500.00	202	EAST500	500.00	1	0.000800	0.010000	0.950000	✓
152	MID500	500.00	3004	WEST	500.00	1	0.003000	0.030000	2.500000	✓
153	MID230	230.00	154	DOWNTN	230.00	2	0.006000	0.054000	0.150000	✓
153	MID230	230.00	3006	UPTOWN	230.00	1	-0.000000	0.000100	0.000000	✓
154	DOWNTN	230.00	155	FACTS TE	230.00	1	0.005000	0.045000	0.100000	✓
154	DOWNTN	230.00	203	EAST230	230.00	1	0.004000	0.040000	0.100000	✓
154	DOWNTN	230.00	205	SUB230	230.00	1	0.000330	0.003330	0.090000	✓
154	DOWNTN	230.00	3008	CATDOG	230.00	1	0.002700	0.022000	0.300000	✓
										✓

◀ ▶ ▶| \ Bus \ Plant \ Machine \ Load \ Fixed Shunt \ Switched Shunt \ **Branch** \ Breaker \ 2 Winding \ 3 Wir

2. Use the above branches as reference of central area to create commands for *area1a.con*.

3. Now open the Notepad program. Save As and Name it "area1a.con" in the file name blank in "Lab4" folder.

4. Type (Do NOT copy the italic words)

   COM

   COM CONTINGENCY description file entry modified by CSU user

   COM

   TRACE *starts the program*

5. The next line names (N-1) contingency where specified and named the contingency for the following line. The following describes which lines will be opened (tripped). In the

end of area1a.con command you should end up with Two ENDS; one for last contingency plan and the other for the whole area1a.con. an example below shown this step:
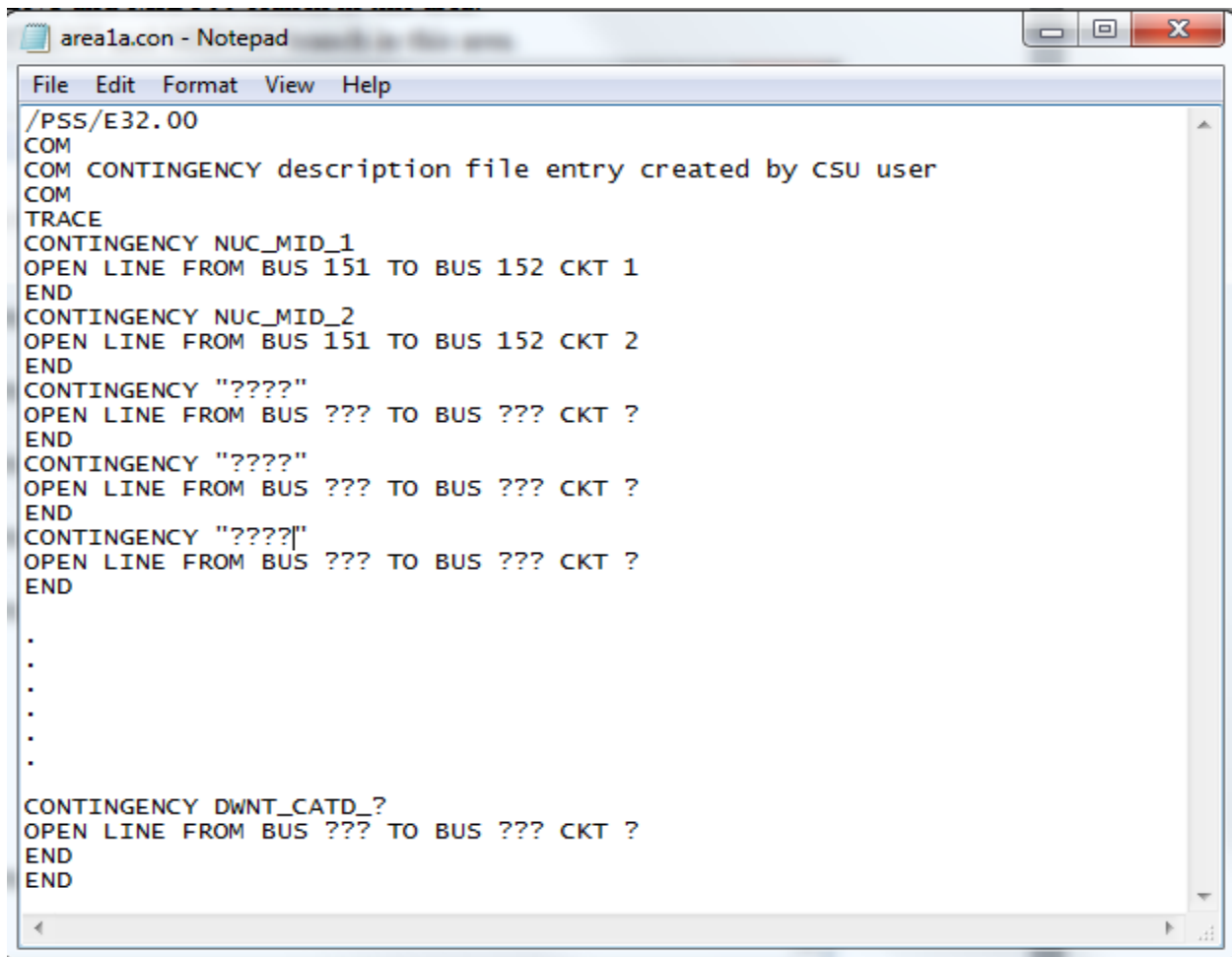
> CONTINGENCY NUC_MID_1
> OPEN LINE FROM BUS 151 TO BUS 152　　　　CKT 1
> END *ends MUC_MID_1 contingency*
> END *ends area1.com*

REMARKS:

NUC_MID_1 name of the contingency for NUCPLNT and MID500 branch and with ID 1

CKT1 refers to the first NUCPLNT and MID500 branch in this area.

CKT2 refers to the second NUCPLNT and MID500 branch in this area.

```
area1a.con - Notepad
File  Edit  Format  View  Help
/PSS/E32.00
COM
COM CONTINGENCY description file entry created by CSU user
COM
TRACE
CONTINGENCY NUC_MID_1
OPEN LINE FROM BUS 151 TO BUS 152 CKT 1
END
CONTINGENCY NUC_MID_2
OPEN LINE FROM BUS 151 TO BUS 152 CKT 2
END
CONTINGENCY "????"
OPEN LINE FROM BUS ??? TO BUS ??? CKT ?
END
CONTINGENCY "????"
OPEN LINE FROM BUS ??? TO BUS ??? CKT ?
END
CONTINGENCY "????"
OPEN LINE FROM BUS ??? TO BUS ??? CKT ?
END


 .
 .
 .
 .
 .
 .


CONTINGENCY DWNT_CATD_?
OPEN LINE FROM BUS ??? TO BUS ??? CKT ?
END
END
```

In order to finish the contingency file "*area1a.con*", the student must complete the remaining:

- Copy the first two contingency plans as explained and shown above.
- Fill "????" with Contingency name, "???" with Bus number in FROM_TO line, and "?" with ID # in the three contingencies followed.
- Write the remains 5 contingencies emulating the syntax structure of the given examples.

- Complete the necessary #'s describes DOWNTN and CATDOG branch. Finish with Two ENDS.
6. By the end you will have 11 total contingencies. Save and close *area1a.con.*

AC Contingency Calculation (ACCC):

The three files area1a.sub, area1a.mon, and area1a.con are utilized to by the AC Contingency Calculation (ACCC) feature of PSS®E to perform a PF study on a particular area or zone. After creating "area1a" files, now it's time to solve the system. Follow the steps below to run ACCC:

1- ACCC icon located on the Fourth Toolbar

*Or* there is always another long way to run the ACCC contingency solution:

a- Go to Toolbar and click on Power Flow menu
b- Scroll down to Solution.
c- Under Solution click on AC contingency solution (ACCC)
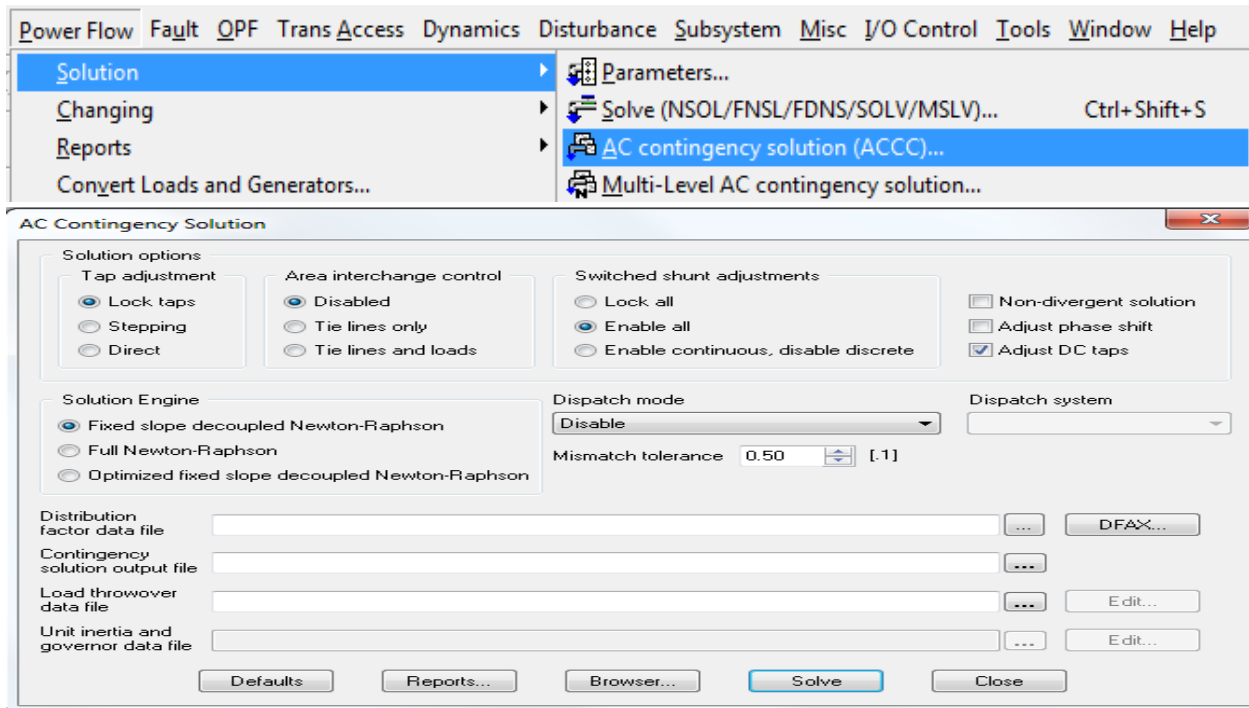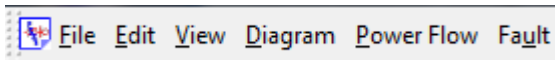
d- Click on DFAX:

Distribution factor data file ... to create **area1a.dfx**.
A Distribution Factor Data File (DFAX) needs to be created by loading the provided **area1a.sub, area1a.mon and area1a.sub** files. Click on the "DFAX" button, and the "Build Distribution Factor Data File" window will be displayed:
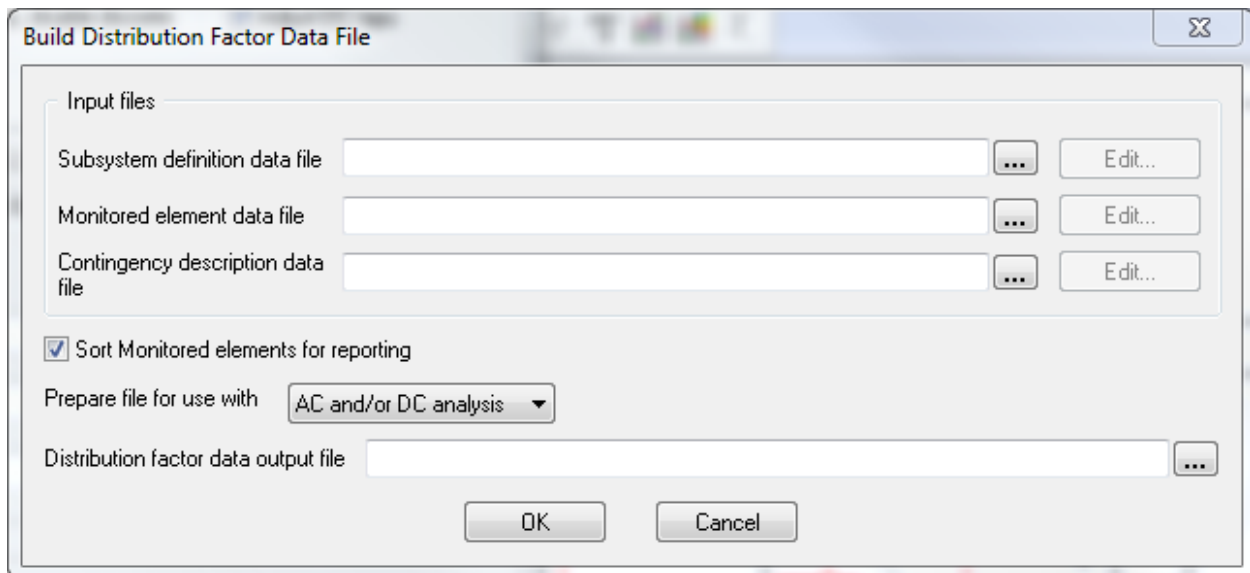
Use the navigation icon [...] to choose the files *area1a.sub, area1a.mon,* and *area1a.con* from "Lab4" folder respectively as shown below. Type "**area1a**" in the Distribution factor data output file.
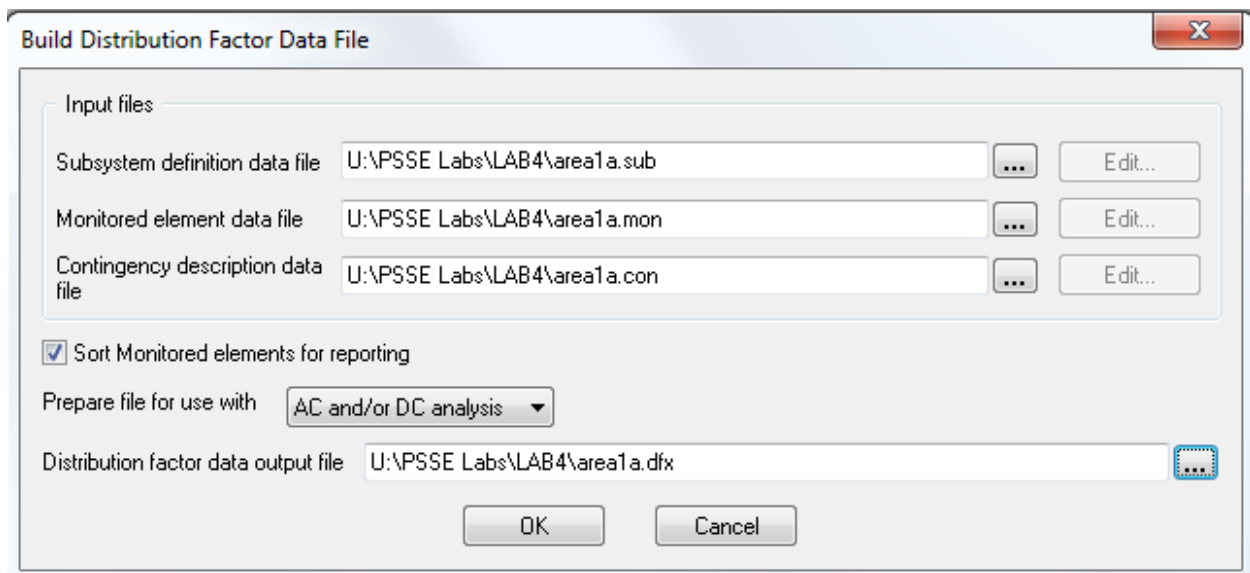

Click OK. Now you have created *area1a.dfx* file.
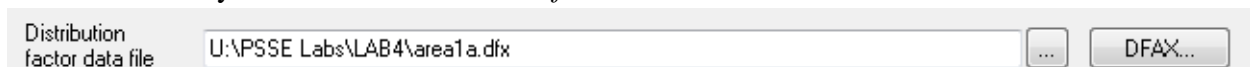
*** If you make changes to your *.sub, *.mon, or *.con files, you MUST re-build the DFAX file. It is not necessary to give it a new name, simply overwrite the existing file.**

e- Contingency solution output file [...]: type in the file name **"area1a"**
Leave Load throwover data file empty.
Click on Solve. Don't close the Window yet!
f- Click on reports the window in the next page will open and make sure you have the correct file name for *.acc file you created above.
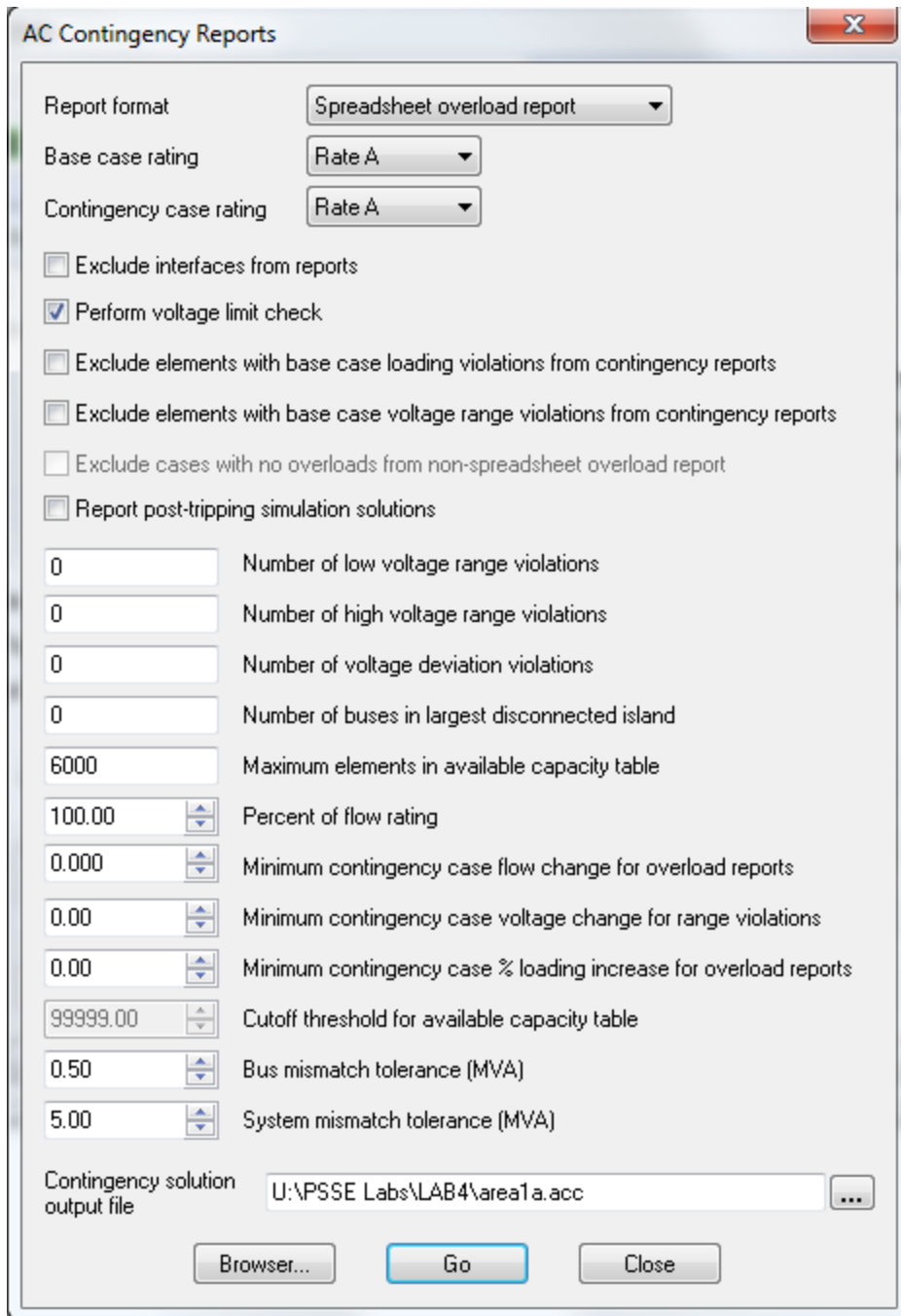
g- Hit GO to run area1a report. Close.

2- Go over the report and check all the files created in this lab are in there.

```
AC CONTINGENCY RESULTS FILE:    U:\PSSE Labs\LAB4\area1a.acc
DISTRIBUTION FACTOR FILE:       U:\PSSE Labs\LAB4\area1a.dfx
SUBSYSTEM DESCRIPTION FILE:     U:\PSSE Labs\LAB4\area1a.sub
MONITORED ELEMENT FILE:         U:\PSSE Labs\LAB4\area1a.mon
CONTINGENCY DESCRIPTION FILE:   U:\PSSE Labs\LAB4\area1a.con
```

PSSE Lab # 4 Questions:

1) Printout area1a.sub file.
2) printout area1a.mon file
3) Complete and Printout area1a.con file.
4) Printout area1a report.
5) Using the lab manual, run ACCC for "area2a" and named the subsystem "EAST_2a". printout the following:
   a) area2a.sub file.
   b) area2a.mon file.
   c) area2a.con file.
   d) "area2a" report.