EE 456: PSSE Project Report

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Introduction

For our power project, we worked on the Eagle power system that is included in chapter 4 of the Power Systems Analysis Textbook. We used the introduction to PSSE instructions provided to us in order to set up the Eagle Power System. This includes 17 buses, branches to connect all of the buses, assigning the buses as Swing bus, Load bus and Generator buses. We then moved on to performing load flow analysis for 3 different tasks. The first one being a normal condition load flow, second one by adding a 40 MW load to the system and increasing the loads of all the other buses by 40% and then running a load flow analysis for that. The third task was performing different contingencies, N-1 contingency consisted of eliminating the branch between bus 5 and bus 11 and then N-2 contingency included the OWL generator outage.

Task 1

Task 1 for this project required the group to go to the Eagle Power system that is in the textbook set up on PSSE, for this we first calculated the values for R and X in pu instead of ohms as shown in the table in figure 1 below. We went on to fill up details about the load, buses as well as the branches that show the connections between different buses, generators and transformers.

From	То	R (Ω)	Χ (Ω)	Base MVA	V Base	BMVA	Z base	R (pu)	X (pu)	B (pu)
1	9	3.085	17.47	100	161	3.629	259.21	0.01190	0.06740	0.03629
1	11	4.718	26.7	100	161	5.55	259.21	0.01820	0.10301	0.05550
1	14	3.629	20.53	100	161	4.264	259.21	0.01400	0.07920	0.04264
2	11	2.774	15.66	100	161	3.251	259.21	0.01070	0.06041	0.03251
2	12	2.618	14.78	100	161	3.07	259.21	0.01010	0.05702	0.03070
2	14	3.085	17.47	100	161	3.629	259.21	0.01190	0.06740	0.03629
3	6	3.551	20.09	100	161	4.174	259.21	0.01370	0.07750	0.04174
3	12	3.551	20.09	100	161	4.174	259.21	0.01370	0.07750	0.04174
3	15	3.033	17.16	100	161	3.569	259.21	0.01170	0.06620	0.03569
4	5	1.529	6.3	100	161	1.232	259.21	0.00590	0.02430	0.01232
4	9	2.411	13.69	100	161	2.843	259.21	0.00930	0.05281	0.02843
5	6	1.97	8.09	100	161	1.584	259.21	0.00760	0.03121	0.01584
5	7	1.089	4.48	100	161	0.88	259.21	0.00420	0.01728	0.00880
5	8	1.996	8.17	100	161	1.599	259.21	0.00770	0.03152	0.01599
7	15	1.866	10.63	100	161	2.208	259.21	0.00720	0.04101	0.02208
8	12	1.27	7.13	100	161	1.482	259.21	0.00490	0.02751	0.01482
5	11	2.514	14.18	100	161	2.949	259.21	0.00970	0.05470	0.02949
10	13	3.033	10.15	100	69	0.408	47.61	0.06371	0.21319	0.00408
10	17	3.433	11.49	100	69	0.462	47.61	0.07211	0.24134	0.00462
13	16	4.642	15.54	100	69	0.624	47.61	0.09750	0.15540	5.0000

Figure 1 - Tabular Information : R(pu) and X(pu) Calculations

	Bus Number	Section Number	Substation Number	Bus Name	Base kV	Area Num	Area Name	Zone Num	Zone Name	Owner Num	Owner Name	Code	Voltage (pu)	Angle (deg)
	1			OWL	161.0	1		2	URBAN	1	EAGLE	3	1.0000	0.00
	2			SWIFT	161.0	1		2	URBAN	1	EAGLE	-2	1.0439	14.9
	3			PARROT	161.0	1		2	URBAN	1	EAGLE	-2	1.0453	17.3
	4			LARK	161.0	1		1	RURAL	1	EAGLE	1	0.9821	5.6
	5			JAY	161.0	1		1	RURAL	1	EAGLE	1	0.9896	7.7
	6			RAVEN	161.0	1		1	RURAL	1	EAGLE	1	0.9982	9.6
	7			WREN	161.0	1		1	RURAL	1	EAGLE	1	0.9899	8.3
	8			ROBIN	161.0	1		1	RURAL	1	EAGLE	1	0.9998	9.3
	9			SISKIN	161.0	1		2	URBAN	1	EAGLE	1	0.9835	2.9
	10			JUNCO	69.0	1		2	URBAN	1	EAGLE	1	0.9294	2.3
	11			QUAIL	161.0	1		2	URBAN	1	EAGLE	1	1.0005	7.8
	12		1	HERON	161.0	1		2	URBAN	1	EAGLE	1	1.0226	13.0
	13			EGRET	69.0	1		2	URBAN	1	EAGLE	1	0.9299	3.8
	14			GULL	161.0	1		2	URBAN	1	EAGLE	1	1.0107	7.5
	15			CROW	161.0	1		2	URBAN	1	EAGLE	1	0.9998	10.5
	16			CROW 69	69.0	1		2	URBAN	1	EAGLE	1	0.9852	7.2
	17			SISKIN 69	69.0	1		2	URBAN	1	EAGLE	1	0.9658	2.5
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Figure 2 - Bus Data (Task 1)

Network data	×																		
Bus Number		Bus Name	ld	Term Node Num	Term Node Name	Code	Area Num	Area Name	Zone Num	Zone Name	Owner Num	Owner Name	In Service	Sc	alable	Inter	ruptible	Pload (MW)	Qload (Mvar)
	4 LARK	161.00	1			1	1		1	RURAL	1	EAGLE			Yes		Yes	60.0000	10.0000
	5 JAY	161.00	1			1	1		1	RURAL	1	EAGLE			Yes		Yes	100.0000	30.0000
	6 RAVEN	161.00	1			1	1		1	RURAL	1	EAGLE			Yes		Yes	80.0000	15.0000
	7 WREN	161.00	1			1	1		1	RURAL	1	EAGLE			Yes		Yes	90.0000	20.0000
	8 ROBIN	161.00	1			1	1		1	RURAL	1	EAGLE			Yes		Yes	40.0000	5.0000
	9 SISKIN	161.00	1			1	1		2	URBAN	1	EAGLE			Yes		Yes	10.0000	5.0000
1	0 JUNCO	69.000	1			1	1		2	URBAN	1	EAGLE			Yes		Yes	15.0000	10.0000
1	1 QUAIL	161.00	1			1	1		2	URBAN	1	EAGLE			Yes		Yes	75.0000	15.0000
1	2 HERON	161.00	1	5	STATION_1_1_5	1	1		2	URBAN	1	EAGLE			Yes		Yes	40.0000	15.0000
1	3 EGRET	69.000	1			1	1		2	URBAN	1	EAGLE			Yes		Yes	30.0000	10.0000
1	4 GULL	161.00	1			1	1		2	URBAN	1	EAGLE			Yes		Yes	35.0000	10.0000
1	5 CROW	161.00	1			1	1		2	URBAN	1	EAGLE			Yes		Yes	10.0000	0.0000
*															Yes		Yes		

Figure 3 - Load Data (Task 1)

Network data 🛛 🛪	<											
From Bus	From Bus	To Bus	To Bus	Id	Name	Term Node	Term Node	Term Node	Term Node	Line R	Line X	Charging B
Number	Name	Number	Name	iu.	Mairie	Num (From)	Name (From)	Num (To)	Name (To)	(pu)	(pu)	(pu)
1	OWL 161.00	9 SISK	IN 161.00	1						0.011900	0.067400	0.036290
1	OWL 161.00	11 QUA	IL 161.00	1						0.018200	0.103010	0.055500
1	OWL 161.00	14 GUL	L 161.00	1						0.014000	0.079200	0.042640
2	SWIFT 161.00	11 QUA	IL 161.00	1						0.010700	0.060410	0.032510
2	SWIFT 161.00	12 HER	ON 161.00	1				2	STATION_1_1_2	0.010100	0.057020	0.030700
2	SWIFT 161.00	14 GUL	L 161.00	1						0.011900	0.067400	0.036290
3	PARROT 161.00	6 RAV	'EN 161.00	1						0.013700	0.077500	0.041740
3	PARROT 161.00	12 HER		1				3	STATION_1_1_3	0.013700	0.077500	
3	PARROT 161.00	15 CR0	W 161.00	1						0.011700	0.066200	0.035690
4	LARK 161.00	5 JAY	161.00	1						0.005900	0.024300	0.012320
4	LARK 161.00	9 SISH	(IN 161.00	1						0.009300	0.052810	0.028430
5	JAY 161.00	6 RAV	'EN 161.00	1						0.007600	0.031210	
5	JAY 161.00	7 WRE	N 161.00	1						0.004200	0.017280	0.008800
5	JAY 161.00	8 ROE	IN 161.00	1						0.007700	0.031520	0.015990
5	JAY 161.00	11 QUA	IL 161.00	1						0.007200	0.041010	0.022080
7	WREN 161.00	15 CR0	W 161.00	1						0.004900	0.027510	0.014820
8	ROBIN 161.00	12 HER	ON 161.00	1				4	STATION_1_1_4	0.009700	0.054700	0.029490
10	JUNCO 69.000	13 EGR	ET 69.000	1						0.063710	0.213190	0.004080
10	JUNCO 69.000	17 SISK	IN 69 69.000	1						0.072110	0.241340	0.004620
13	EGRET 69.000	16 CR0	W 69 69.000	1						0.097500	0.155400	0.006240

Figure 4 - Branch Data (Task 1)

	let	twork data 🔉	<											
		From Bus	F	rom Bus	To Bus	T	o Bus	ld	Name	Term	Term Node	Term Node	Term Node	In
		Number		Name	Number		Name	iu.	Maine	Node	Name (From)	Num (To)	Name (To)	Service
		9	SISKIN	161.00	17	SISKIN 69	69.000	T1	TRANS1					
		15	CROW	161.00	16	CROW 69	69.000	T2	TRANS2					
)	ŧ													

Figure 5 - Transformer Data (Task 1)

Task 2

Design Exercise D10.1-Phase I Power Flow Study-Case 3

For this part of the project we added a new load of 40 MW called Steel Mill load. With that the base loads were also increased by 30%, with this change we ended up getting voltages outside the regulatory limits. This led us to change the connections in a way that our Steel Mill load which was at bus 18 to be connected to the two generators as well as the 161 kV sides of the two transformers in our model, bus 9 and 15. To be precise we were getting a result of less 0.96 for bus 10 and 13 and our goal was to increase that which we accomplished by doing the above changes. By having the steel mill connect bus 9 and 15 to the generators in bus 2 and 3, we were able to get the voltage in bus 10 and 13 to get above 0.96 pu.

Learner Total RD										% I F	OR NON-TR	ANSF	ORMEI	R BRANCHE	S		
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$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	13	EGRET	69,000	1 0,9665	-1.7	0.0	39.0	0.0 -									
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$									10	JUNCO	69.000	1	1	-4.4	-0.9		
2 162.85 0.0 10.0 -0.0 1 ONL 161.00 1 1 25.4 8.2 15 CROW 161.00 1 1.0317 3.6 0.0 -0.0 3 PARROT 161.00 1 1 -70.9 -18.2 15 CROW 161.00 1 1.0317 3.6 0.0 -0.0 3 PARROT 161.00 1 1 0.0 -1.9 16 CROW 69.000 1 1.0167 1.0 0.0 -0.0 3 PARROT 161.00 1 1 0.0 -1.9 16 CROW 69 69.000 1 1.0167 1.0 0.0 -0.0 -0.0 -1.8 -253.2 -52.2 -52.2 16 CROW 69 69.000 1 1.0157 0.0 0.0 -0.0 -0.0 -1.5 CROW 1 1 35.9 10.6 1.000UN 17 SISKIN 69 69.000 1 1.0157 1.8 0.0 -0.0 -0.0 -1.0 1.000UN 1 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>16</td> <td>CROW 69</td> <td>69.000</td> <td>1</td> <td>1</td> <td>-34.6</td> <td>-9.1</td> <td></td> <td></td>									16	CROW 69	69.000	1	1	-34.6	-9.1		
15 CROW 161.00 1 1.0317 3.6 0.0 13.0 0.0	14	GULL	161.00		1.1												
15 CROW 161.00 1 1.0317 3.6 0.0 13.0 0.0				2 162.85		0.0	10.0	-0.0									
2 166.10 0.0 -0.0 3 PARROT 161.00 1 1 0.0 -1.9 7 WREN 161.00 1 1 204.3 41.6 16 CROW 69 69.000 1 1.0167 1.0 0.0 -0.0 1 1 204.3 41.6 16 CROW 69 69.000 1 1.0167 1.0 0.0 0.0 -0.0 18 STEEL MILL 161.00 1 1 -253.2 -52.2 16 CROW 69 69.000 1 1.0167 0.0 0.0 -0.0 13 EGRET 69.000 1 1 35.9 10.6 17 SISKIN 69 69.000 1 1.0157 1.8 0.0 0.0 -0.0 -0.0 1 1 35.9 -10.6 1.000UN 17 SISKIN 69 69.000 1 1.0157 1.8 0.0 -0.0 -0.0 -0.0 1 1 24.4 -11.8 1.000UN 18 STEEL MILL 161.00 1 1	15	CROW	161 00	1 1 0017	2.0		12.0	0.0	2	SWIFT	161.00	1	1	-70.9	-18.2		
16 CROW 69 69.000 1 1.0167 1.0 0.0 0.0 0.0 -0.0 13 EGRET 69.000 1 1 -25.2 -52.2 16 CROW 69 69.000 1 1.0167 1.0 0.0 0.0 -0.0 13 EGRET 69.000 1 1 35.9 12.4 1.000LK 17 SISKIN 69 69.000 1 1.0157 1.8 0.0 0.0 -0.0 15 CROW 161.00 1 1 35.9 10.6 1.000UN 17 SISKIN 69 69.000 1 1.0157 1.8 0.0 0.0 -0.0 9 SISKIN 161.00 1 T -24.4 -11.8 1.000UN 18 STEEL MILL 161.00 1 1.0317 3.6 0.0 81.3 0.0 0.0 1 1 -24.4 -11.8 1.000UN 18 STEEL MILL 161.00 1 1 -24.3 -47.4 -43.75 -47.4 3 PARROT 161.00 1 <td>10</td> <td>CROW</td> <td>101.00</td> <td></td> <td>5.6</td> <td></td> <td></td> <td></td> <td>3</td> <td>PARROT</td> <td>161 00</td> <td>1</td> <td>1</td> <td> </td> <td>-1 9</td> <td></td> <td> </td>	10	CROW	101.00		5.6				3	PARROT	161 00	1	1	 	-1 9		
16 CROW 69 69.000 1 12.4 1.00LK 16 CROW 69 69.000 1 1.0167 1.0 0.0 0.0 0.0 16 CROW 69 69.000 1 1.0167 1.0 0.0 0.0 0.0 1 1 -253.2 -52.2 16 CROW 69 69.000 1 1.0167 0.0 0.0 0.0 -0.0 13 EGRET 69.000 1 1 35.9 10.6 17 SISKIN 69 69.000 1 1.0157 1.8 0.0 0.0 -0.0 1 1 1 35.9 -10.6 1.000UN 17 SISKIN 69 69.000 1 1.0157 1.8 0.0 0.0 -0.0 -0.0 9 SISKIN 161.00 1 1 -24.4 -11.8 1.000UN 18 STEEL MILL 161.00 1 1 -24.4 11.8 1.000UN 18 STEEL MILL 161.00 1 1 -24.5 -47.4 18 STEEL MILL <td></td> <td></td> <td></td> <td>2 100.10</td> <td></td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>				2 100.10		0.0	0.0	0.0									
16 CROW 69 69.000 1 1.0167 1.0 0.0 0.0 0.0																1.000LK	
2 70.150 0.0 0.0 -0.0 13 EGRET 69.000 1 1 35.9 10.6 17 SISKIN 69 69.000 1 1.0157 1.8 0.0 0.0 -0.0 15 CROW 161.00 1 T2 -35.9 -10.6 1.000UN 17 SISKIN 69 69.000 1 1.0157 1.8 0.0 0.0 -0.0 9 SISKIN 161.00 1 T1 -24.4 -11.8 1.000UN 18 STEEL MILL 161.00 1 1.0317 3.6 0.0 81.3 0.0 -0.0 2 SWIFT 161.00 1 -24.4 11.8 18 STEEL MILL 161.00 1 1.0317 3.6 0.0 -0.0 2 SWIFT 161.00 1 -243.5 -47.4 3 PARROT 161.00 1 1 -243.7 -76.3 -9 9 SISKIN 161.00 1 1 25.9 71.5 -71.5									18								
17 SISKIN 69 69.000 1 1.0157 1.8 0.0 0.0	16	CROW 69	69.000		1.0												
17 SISKIN 69 69.000 1 1.0157 1.8 0.0 0.0 0.0				2 70.150		0.0	0.0	-0.0								4 0000	
2 70.082 0.0 0.0 -0.0 9 SISKIN 161.00 1 T1 -24.4 -11.8 1.000UN 18 STEEL MILL 161.00 1 1.0317 3.6 0.0 81.3 0.0	17		69 000	1 1 0157	1 9	0.0	0.0	0.0							-10.6	T.0000N	
10 JUNCO 69.000 1 24.4 11.8 18 STEEL MILL 161.00 1 1.0317 3.6 0.0 81.3 0.0	1/	PTPKTN 09	09.000		1.0										-11 8	1 00000	
18 STEEL MILL 161.00 1 1.0317 3.6 0.0 81.3 0.0				2 70.002		0.0	0.0	-0.0								1.00000	
3 PARROT 161.00 1 1 -347.0 -76.3 9 SISKIN 161.00 1 1 255.9 71.5	18	STEEL MILL	161.00	1 1.0317	3.6	0.0	81.3	0.0 -									
9 SISKIN 161.00 1 1 255.9 71.5				2 166.10		0.0	0.0	-0.0									
									1.7		101.00	1	1	200.2	32.2		

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Figure 6 - Load Flow for Task 2

Net	work data 🗴	< C												
	Bus Number	Section Number	Substation Number	Bus Name	Base kV	Area Num	Area Name	Zone Num	Zone Name	Owner Num	Owner Name	Code	Voltage (pu)	Angle (deg)
	1			OWL	161.0	1		2	URBAN	1	EAGLE	3	1.0000	0.00
	2			SWIFT	161.0	1		2	URBAN	1	EAGLE	-2	1.0317	3.57
	3			PARROT	161.0	1		2	URBAN	1	EAGLE	-2	1.0317	3.57
	4			LARK	161.0	1		1	RURAL	1	EAGLE	1	1.0107	0.29
	5			JAY	161.0	1		1	RURAL	1	EAGLE	1	1.0065	-0.20
	6			RAVEN	161.0	1		1	RURAL	1	EAGLE	1	1.0061	-0.37
	7			WREN	161.0	1		1	RURAL	1	EAGLE	1	1.0120	0.60
	8			ROBIN	161.0	1		1	RURAL	1	EAGLE	1	1.0085	-0.10
	9			SISKIN	161.0	1		2	URBAN	1	EAGLE	1	1.0317	3.57
	10			JUNCO	69.0	1		2	URBAN	1	EAGLE	1	0.9709	-1.13
	11			QUAIL	161.0	1		2	URBAN	1	EAGLE	1	1.0076	0.03
	12		1	HERON	161.0	1		2	URBAN	1	EAGLE	1	1.0186	1.65
	13			EGRET	69.0	1		2	URBAN	1	EAGLE	1	0.9665	-1.68
	14			GULL	161.0	1		2	URBAN	1	EAGLE	1	1.0115	1.06
	15			CROW	161.0	1		2	URBAN	1	EAGLE	1	1.0317	3.57
	16			CROW 69	69.0	1		2	URBAN	1	EAGLE	1	1.0167	0.96
	17			SISKIN 69	69.0	1		2	URBAN	1	EAGLE	1	1.0157	1.79
	18			STEEL MILL	161.0	1		2	URBAN	1	EAGLE	1	1.0317	3.57

Figure 7 - Bus Data (Task 2)

Ne	twork data 🗙																		
	Bus	Bus	Id	Term Node	Term Node	Area	Area	Zone	Zone	Code	VSched	Regulated Bus	In	PGen	PMax	PMin	QGen	QMax	QMin
	Number	Name		Num	Name	Num	Name	Num	Name	couc	(pu)	Number	Service	(MW)	(MW)	(MW)	(Mvar)	(Mvar)	(Mvar)
	1 OV	L 161.00	1			1		2	URBAN	3	1.0000	1		-127.1364	9999.0000	-9999.0000	-49.9639	250.0000	100.0000
	2 SV	FT 161.00	1			1		2	URBAN	-2	1.0000	2		490.0000	9999.0000	-9999.0000	100.0000	250.0000	100.0000
	3 PA	ROT 161.00	1			1		2	URBAN	-2	1.0000	3		490.0000	9999.0000	-9999.0000	100.0000	250.0000	100.0000

Figure 8 - Generator Data (Task 2)

From	n Bus	From Bus	To Bus	To Bu	IS .	Id	Nama	Term Node	Term Node	Term Node	Term Node	Line R	Line X	Charging B
Num	nber	Name	Number	Nam	e '	Ia	Name	Num (From)	Name (From)	Num (To)	Name (To)	(pu)	(pu)	(pu)
	1	OWL 161.00	9 S	ISKIN 161	.00 1							0.011900	0.067400	0.036290
	1	OWL 161.00	11 Q	UAIL 161	.00 1							0.018200	0.103010	0.055500
	1	OWL 161.00	14 G	ULL 161	.00 1	Ĩ						0.014000	0.079200	0.042640
	2	SWIFT 161.00	11 Q	IUAIL 161	.00 1							0.010700	0.060410	0.032510
	2	SWIFT 161.00	12 H	ERON 16	1.00 1					2	STATION_1_1_2	0.010100	0.057020	0.030700
	2	SWIFT 161.00	14 G	ULL 161	.00 1							0.011900	0.067400	0.036290
	2	SWIFT 161.00	18 S	TEEL MILL 1	61.00 1							0.000000	0.000100	0.000000
	3	PARROT 161.00	6 R	AVEN 16	1.00 1							0.013700	0.077500	0.041740
	3	PARROT 161.00	12 H	ERON 16	1.00 1					3	STATION_1_1_3	0.013700	0.077500	0.041740
	3	PARROT 161.00	15 C	ROW 16	1.00 1							0.011700	0.066200	0.035690
	3	PARROT 161.00	18 S	TEEL MILL 1	61.00 1							0.000000	0.000100	0.000000
	4	LARK 161.00	5 J/	AY 161.	00 1							0.005900	0.024300	0.012320
	4	LARK 161.00	9 S	ISKIN 161	.00 1							0.009300	0.052810	0.028430
	5	JAY 161.00	6 R	AVEN 16	1.00 1							0.007600	0.031210	0.015840
	5	JAY 161.00	7 W	/REN 161	1.00 1							0.004200	0.017280	0.008800
	5	JAY 161.00	8 R	OBIN 161	.00 1							0.007700	0.031520	0.015990
	5	JAY 161.00	11 Q	UAIL 161	.00 1	Ĩ						0.007200	0.041010	0.022080
	7	WREN 161.00	15 C	ROW 16	1.00 1							0.004900	0.027510	0.014820
	8	ROBIN 161.00	12 H	ERON 16	1.00 1					4	STATION_1_1_4	0.009700	0.054700	0.029490
	9	SISKIN 161.00	18 S	TEEL MILL 1	61.00 1							0.000000	0.000100	0.000000
	10	JUNCO 69.000	13 E	GRET 69.	000 1							0.063710	0.213190	0.004080
	10	JUNCO 69.000	17 S	ISKIN 69 69	.000 1							0.072110	0.241340	0.004620
	13	EGRET 69.000	16 C	ROW 69 6	9.000 1							0.097500	0.155400	0.006240
	15	CROW 161.00	18 S	TEEL MILL 1	61.00 1							0.000000	0.000100	0.000000

Figure 9 - Branch Data (Task 2)

Net	vork data 🔉	<																
	Bus Number		Bus Name	ld	Term Node Num	Term Node Name	Code	Area Num	Area Name	Zone Num	Zone Name	Owner Num	Owner Name	In Service	Scalable	Interruptible	Pload (MW)	Qload (Mvar)
	4	LARK	161.00	1			1	1		1	RURAL	1	EAGLE	\triangleleft	✓ Yes	Yes	78.0000	10.0000
	5	JAY	161.00	1			1	1		1	RURAL	1	EAGLE		Ves Yes	Yes	130.0000	30.0000
	6	RAVEN	161.00	1			1	1		1	RURAL	1	EAGLE		V Yes	Ves	104.0000	15.0000
	7	WREN	161.00	1			1	1		1	RURAL	1	EAGLE		Ves	Yes	117.0000	20.0000
	8	ROBIN	161.00	1			1	1		1	RURAL	1	EAGLE		Ves	Ves	52.0000	5.0000
	9	SISKIN	161.00	1			1	1		2	URBAN	1	EAGLE		Ves	Yes	13.0000	5.0000
	10	JUNCO	69.000	1			1	1		2	URBAN	1	EAGLE		Ves	Yes	19.5000	10.0000
	11	QUAIL	161.00	1			1	1		2	URBAN	1	EAGLE		Ves	Yes	97.5000	15.0000
	12	HERON	161.00	1	5	STATION_1_1_5	1	1		2	URBAN	1	EAGLE		Ves	Yes	52.0000	15.0000
	13	EGRET	69.000	1			1	1		2	URBAN	1	EAGLE		Ves	Yes	39.0000	10.0000
	14	GULL	161.00	1			1	1		2	URBAN	1	EAGLE		Ves	Ves	45.5000	10.0000
	15	CROW	161.00	1			1	1		2	URBAN	1	EAGLE		V Yes	Yes	13.0000	0.0000
•	18	STEEL M	ILL 161.00	1			1	1		1	RURAL	1	EAGLE		Ves	Yes	40.0000	0.0000

Figure 10- Load Data (Task 2)

Task 3

For this task we performed two contingencies, N-1 and N-2 both with increase in the loads by 30%. For N-1 contingency we removed the line 5-11 to resolve the power flow. Then with the same conditions we also had to consider the OWL generator outage We then were required to figure out which bus had the most change in voltage magnitude and which line had the most change in MW line flow between both N-1 and N-2 contingency.

Comparing the two N-1 and N-2 contingencies to identify the voltage magnitude and the MW line flow that changes the most, we find that bus 13 changes its voltage magnitude the most and line 2-18 has the highest MW line flow. In bus 13, the voltage in pu changes from 0.9652 to 0.9320 giving it a total change of 0.0332. In line 2-18, the MW line flow changes from 250.9 to 181.5 giving it a total change of 69.4 MW.

										% I	FOR NON-TRA	NSFOR	MER	BRANCHES			
	FROM BUS X NAME				ANGLE	gen Mw/Mvar	load Mw/mvar				X BASKV A		KT	MW	MVAR	TRANSFO RATIO	RATING % SET
1	OWL	161.00		1.0000	0.0	-127.1	0.0										
			2	161.00		-47.4L	0.0	-0.0	9	SISKIN	161.00	1		-98.1	-26.8		
									11 14	QUAIL GULL	161.00 161.00	1 1		-4.7 -24.4	-9.3 -11.3		
2	SWIFT	161.00	1	1.0305	3.5	490.0	0.0	0.0									
			2	165.90		100.0L	0.0	-0.0	11	QUAIL	161.00	1	_	103.3	21.8		
									12	HERON	161.00	1		65.3	12.0		
									14 18	GULL	161.00 L 161.00	1 1	-	70.5 250.9	17.1 49.1		
3	PARROT	161.00	1	1.0305	3.5	490.0	0.0	0.0	10	SICCL MIL				250.9	49.1		
-				165.90		100.0L	0.0	-0.0	6	RAVEN	161.00	1	1	97.5	18.7		
									12	HERON	161.00	1		48.0	7.8		
									15	CROW	161.00	1		0.0	-1.9		
4	LARK	161.00	1	1.0088	0.2	0.0	78.0	0.0	18	SIEEL MIL	L 161.00	1	1	344.4	75.3		
-	CAN	101.00		162.42	0.2	0.0	10.0	-0.0	5	JAY	161.00	1	1	40.4	8.5		
									9	SISKIN	161.00	1		-118.4	-18.5		
5	JAY	161.00		1.0043	-0.4	0.0	130.0	0.0									
			1	161.70		0.0	30.0	-0.0	4	LARK	161.00	1		-40.3	-9.3		
									6 7	RAVEN WREN	161.00 161.00	1 1		7.8	-2.4 -12.4		
									8	ROBIN	161.00	1		-8.2	-5.9		
6	RAVEN	161.00	1	1.0042	-0.5	0.0	104.0	0.0									
			1	161.68		0.0	15.0	-0.0	3	PARROT	161.00	1		-96.2	-15.8		
7	WREN	161.00	1	1 0100	0.5	0.0	117.0	0.0	5	JAY	161.00	1	1	-7.8	0.8		
/	WREN	101.00		1.0102 162.65	0.5	0.0	20.0	-0.0	5	JAY	161.00	1	1	89.6	12.9		
			-	102.05		0.0	20.0	0.0	15	CROW	161.00	1		-206.6	-32.9		
8	ROBIN	161.00		1.0066	-0.2	0.0	52.0										
			1	162.06		0.0	5.0	-0.0	5	JAY	161.00	1		8.2	4.3		
9	STSKTN	161.00	1	1.0305	3.5	0.0	13.0	0.0	12	HERON	161.00	1		-60.2	-9.3		
9	STREEM	101.00		165.90	5.5	0.0	5.0	-0.0	1	OWL	161.00	1		99.3	30.0		
			-	200100		0.0	5.0		4	LARK	161.00	1		119.7	23.0		
									17	SISKIN 69		1		24.4		1.000LK	
									18	STEEL MIL	L 161.00	1	1	-256.4	-70.7		
10	JUNCO	69.000		1 0.9696)								
				2 66.904	•	0.0	10.0	9 -0.0) 13 17	EGRET SISKIN 6	69.000 69 69.000		1 1	4.4 -23.9	0.5 -10.5		
11	QUAIL	161.00	a .	1 1.0076	0.2	0.0	97.	5 0.0	, 17)	212/11/ 0		±		-25.9	-10.5		
				2 162.22		0.0				OWL	161.00	1	1	4.7	3.8		
					-	_			2	SWIFT	161.00		1	-102.2	-18.8		
12	HERON	161.00		1 1.0171)	CWILL	161 00		4	CA 0	40.0		
				2 163.75	•	0.0	15.0	9 -0.0) 2 3	SWIFT	161.00 161.00		1 1	-64.9 -47.7	-12.8		
									8	ROBIN	161.00		1	60.6	8.3		
13	EGRET	69.000		1 0.9652)								
				2 66.596	5	0.0	10.0	9 -0.0		JUNCO	69.000		1	-4.4	-0.9		
14	GULL	161.00	a .	1 1.0108	1.0	0.0	45.	5 0.0	16	CROW 69	69.000	1	1	-34.6	-9.1		
14	GULL	101.06		1 1.0108		0.0				OWL	161.00	1	1	24.4	7.5		
						0.0	2011		2	SWIFT	161.00		1	-70.0	-17.5		
15	CROW	161.00		1 1.0305)								
			1	2 165.90		0.0	0.0	0.0		PARROT	161.00		1	0.0	-1.9		
									7 16	WREN CROW 69	161.00 69.000	1 1		208.7 35.9	43.1	1.000LK	
									18		ILL 161.00	1		-257.6	-53.7	1.000LK	
16	CROW 69	69.000		1 1.0154)								
			1	2 70.063	5	0.0	0.0	0.0		EGRET	69.000		1	35.9	10.6		
17	SISKIN 6	9 69.000	a ,	1 1.0144	1.7	0.0	0.0	a e (15)	CROW	161.00		T2			1.000UN	
1/	SISKIN 6	9 69.000		1 1.0144 2 69.995		0.0 0.0				SISKIN	161.00		T1	-24.4		1.000UN	
				_ 05.555		0.0	0.0	-0.0	, s 10	JUNCO	69.000		1	24.4	11.8		
18	STEEL MI	LL 161.00		1 1.0305)								
			1	2 165.90	•	0.0	0.0	0.0-		SWIFT	161.00		1	-250.9			
									3	PARROT SISKIN	161.00 161.00		1 1	-344.4 256.4			
									15	CROW	161.00		1	256.4	70.7 53.7		
									10	CHOR	101.00	1	-	257.0	55.7		

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Figure 11 - Load Flow for N-1 contingency (Task 3)

										% I FC	DR NON-TRA	ANSFO	ORMER	BRANCHE	s		
X BUS#-SCT					ANGLE	gen Mw/MVAR	load Mw/Mvar			TO BUS - X NAME				MW	MVAR	TRANSF RATIO	RATING % SET
1	OWL	161.00	1	0.9957	2.3	0.0	0.0	0.0									
			2	160.31		0.0	0.0	-0.0	9	SISKIN	161.00			-30.6	-2.4		
									11	QUAIL	161.00		1	23.7	1.9		
2	CUTCT	464 00	4	1 0000	3.5	260.2		0.0	14	GULL	161.00		1	6.9	0.5		
2	SWIFT	161.00		1.0000 161.00	3.5	360.2 46.3L	0.0 0.0	0.0 -0.0	11	QUAIL	161.00		1	74.6	8.5		
			2	101.00		40.50	0.0	-0.0	12	HERON	161.00		1	65.3	12.6		
									14	GULL	161.00		1	38.8	2.7		
									18	STEEL MILL		1	1	181.5	22.5		
3	PARROT	161.00		1.0000	3.5	490.0	0.0	0.0	·····						40.5		
			2	161.00		100.0L	0.0	-0.0	6 12	RAVEN HERON	161.00 161.00		1 1	97.6 48.1	19.5 8.3		
									15	CROW	161.00		1	0.0	-1.8		
									18	STEEL MILL			1	344.3	74.0		
4	LARK	161.00		0.9775	-0.1	0.0	78.0										
			1	157.37		0.0	10.0	-0.0	5	JAY	161.00		1	40.4	8.6		
5	JAY	161.00	1	0.9728	-0.6	0.0	130.0	0 0	9	SISKIN	161.00	_	1	-118.4	-18.6		
5	JAI	101.00		156.62	-0.0	0.0	30.0	-0.0	4	LARK	161.00		1	-40.3	-9.4		
									6	RAVEN	161.00	1	1	7.8	-2.2		
									7	WREN	161.00		1	-89.3	-12.6		
	DAVEN	464 00		0.0707			404.0	0.0	8	ROBIN	161.00	1	1	-8.2	-5.8		
6	RAVEN	161.00		0.9727 156.60	-0.8	0.0 0.0	104.0 15.0	0.0 -0.0	3	PARROT	161.00	1	1	-96.2	-15.8		
			-	190.00		0.0	10.0	0.0	5	JAY	161.00		1	-7.8	0.8		
7	WREN	161.00	1	0.9789	0.3	0.0	117.0	0.0									
			1	157.61		0.0	20.0	-0.0	5	JAY	161.00		1	89.6	13.3		
8	ROBIN	161.00	1	0.9751	-0.5	0.0	52.0	0.0	15	CROW	161.00		1	-206.6	-33.3		
0	NODIN	101.00		156.98	-0.5	0.0	5.0	-0.0	5	14Y	161.00		1	8.2	4.3		
			-						12	HERON	161.00	1	1	-60.2	-9.3		
9	SISKIN	161.00		1.0000	3.5	0.0	13.0										
			2	161.00		0.0	5.0	-0.0	1	OWL	161.00		1	30.7	-0.6		
									4 17	LARK SISKIN 69	161.00 69.000		1 T1	119.8 24.5	23.8	1.000LK	
									18	STEEL MILL			1	-188.0	-41.2	1.000LK	
10	JUNCO	69.000	1	0.9366	-1.5	0.0	19.5	0.0									
			2	64.627		0.0	10.0	-0.0	13	EGRET	69.000		1	4.4	0.6		
									17	SISKIN 69	69.000	1	1	-23.9	-10.6		
11	QUAIL	161.00		0.9869	1.0	0.0	97.5				4.64 00						
			2	158.89		0.0	15.0	-0.0	1 2	OWL SWIFT	161.00 161.00		1 1	-23.5 -74.0	-6.7 -8.3		
12	HERON	161.00	1	0.9860	1.4	0.0	52.0	0.0			101.00			-/4.0	-0.5		
				158.75		0.0	15.0	-0.0		SWIFT	161.00	1	1	-64.9	-13.0		
										PARROT	161.00		1	-47.7	-10.5		
12	FGRET	69,000	1	0.0220	-2.1	0.0	39.0	0.0	8	ROBIN	161.00	1	1	60.6	8.6		
13	EGRET	69.000		0.9320 64.307	-2.1	0.0 0.0	10.0	-0.0	10	JUNCO	69,000	1	1	-4.4	-0.9		
			-	0			2010	0.0	16	CROW 69	69.000		1	-34.6	-9.1		
14	GULL	161.00		0.9927	2.0	0.0	45.5	0.0									
			2	159.82		0.0	10.0	-0.0		OWL	161.00		1	-6.9	-4.7		
15	CROW	161.00	1	1.0000	3.5	0.0	13.0	00	2	SWIFT	161.00		1	-38.6	-5.3		
15	chon	101.00		161.00	5.5	0.0	0.0	-0.0		PARROT	161.00	1	1	0.0	-1.8		
									7	WREN	161.00	1	1	208.9	44.4		
										CROW 69	69.000		T2	36.0		1.000LK	
16	CROW 69	69.000	1	0.9841	0.7	0.0	0.0	0.0	10	STEEL MILL			1	-257.9	-55.4		
10	511011 05	05.000		67.905	5.7	0.0	0.0	-0.0	13	EGRET	69.000		1	36.0	10.8		
									15	CROW	161.00		T2	-36.0	-10.8	1.000UN	
17	SISKIN 69	69.000		0.9832	1.6	0.0	0.0	0.0									
			2	67.839		0.0	0.0	-0.0	9 10	SISKIN JUNCO	161.00 69.000		T1 1	-24.5 24.5	-12.0 12.0	1.000UN	
18	STEEL MIL	L 161.00	1	1.0000	3.5	0.0	80.0	0.0	10	JUNCU	69.000		· · · · ·	24.3	12.0		
				161.00		0.0	0.0	-0.0	2	SWIFT	161.00	1	1	-181.5	-22.5		
										PARROT	161.00	1	1	-344.3	-74.0		
									9 15	SISKIN CROW	161.00 161.00	1	1 1	188.0 257.9	41.2 55.4		
									13	CITON	101.00	т	+	231.7	55.4		

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E THU, DEC 16 2021 11:22 2010 A FOR TRANSFORMERS % I FOR NON-TRANSFORMER BRANCHES

Figure 12 - Load Flow for N-2 contingency (Task 3)