Introduction to Machine Learning Assignment 4

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Question 1 Answer:

a) (The Python code for this is in the file: 1_a.py)

Output Screenshot:

```
vivekmalipatel@Viveks-MacBook-Pro Assignment4 % /usr/local/bin/python3 "/Users/v
Intro to ML/Assignments/Assignment4/1a.py"
Area Under Curve value:  0.5
vivekmalipatel@Viveks-MacBook-Pro Assignment4 %
```

Answer:

Area Under the cure: 0.5

b) (The Python code for this is in the file: 1_b.py)

Output Screenshot:

```
vivekmalipatel@Viveks-MacBook-Pro Assignment4 % /usr/local/bin/python3 "
/Intro to ML/Assignments/Assignment4/1b.py"
Root Average Squared Error:  0.3661883134259858
vivekmalipatel@Viveks-MacBook-Pro Assignment4 %
```

Answer:

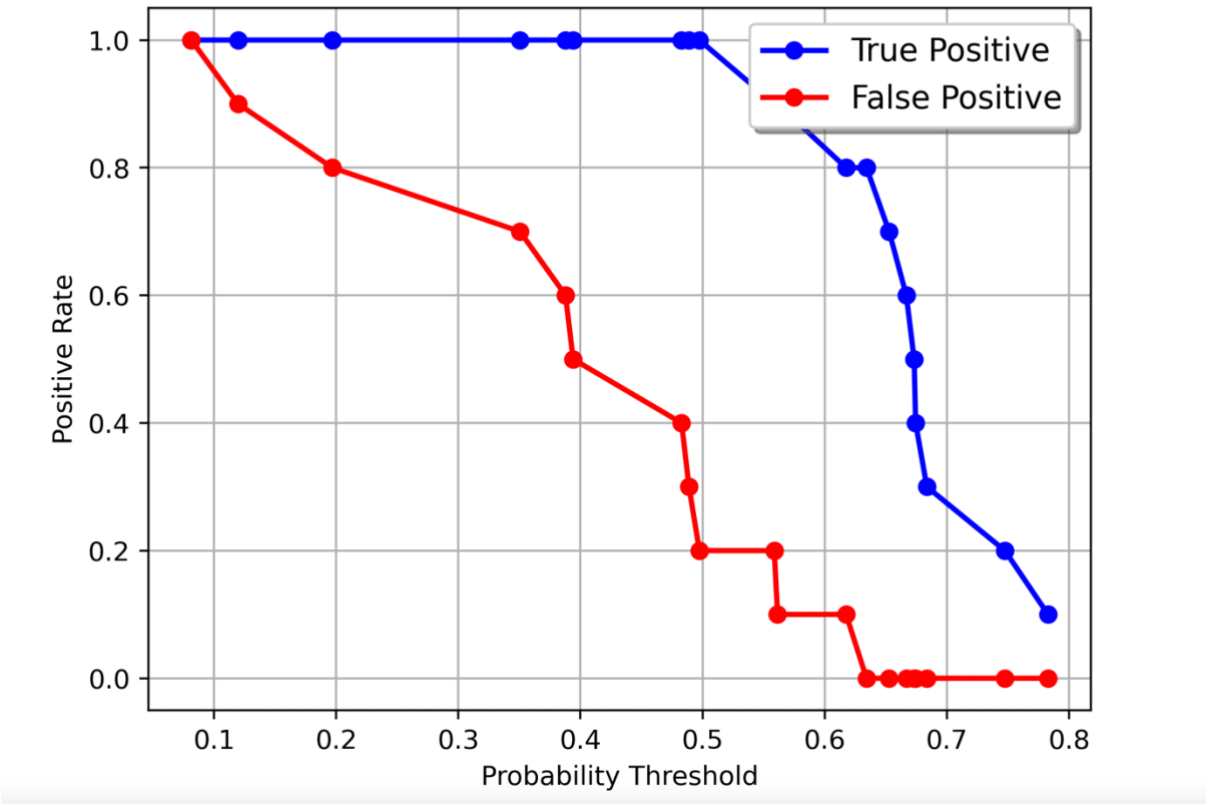
Root Average Squared Error: 0.3661883134259858

c) Based on the AUC value, its and Inconclusive scenario as AUC=0.5.
But, based on the RASE value, the current model that we are using can be considered as RASE < 0.5.

Question 2 Answers:

a) (The Python code for this is in the file: 2_a.py)

Kolmogorov–Smirnov curve :



Output Screenshot :

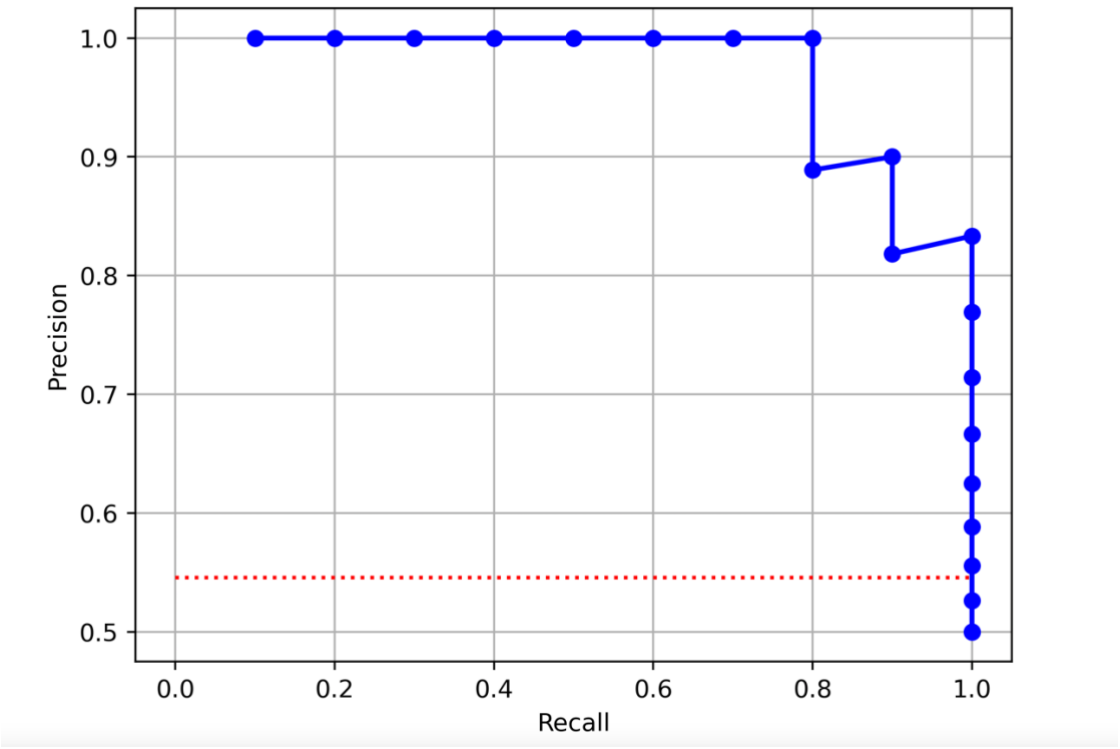
```
vivekmalipatel@Viveks-MacBook-Pro Assignment4 % /usr/local/bin/python3 "/Users/v
ivekmalipatel/Library/CloudStorage/GoogleDrive-vmalipatel@hawk.iit.edu/My Drive/
Intro to ML/Assignments/Assignment4/2a.py"
probability threshold that yields the highest Kolmogorov-Smirnov statistic =  0.6342
```

Answer :

Probability threshold that yields the highest Kolmogorov–Smirnov statistic = 0.6342

b) (The Python code for this is in the file: 2_b.py)

Precision-Recall curve:



Output Screenshot :

```
/Intro to ML/Assignments/Assignment4/2b.py"
the probability threshold that yields the highest F1 Score =  0.4974
```

Answer :

the probability threshold that yields the highest F1 Score = 0.4974

c) (The Python code for this is in the file: 2_b.py)

Output Screenshot :

```
Misclassification Rate for parts (a) : 0.1000000000000
Misclassification Rate for parts (b) : 0.1000000000000
```

Answer :
Misclassification Rate for parts (a) : 0.1000000000000
Misclassification Rate for parts (b) : 0.1000000000000

Question 3 Answers:

a) (The Python code for this is in the file: 3_a.py)

Grid search results :

	Activation Function	nLayer	nHiddenNeuron	N Iteration	Loss	RMSE	RelErr	Pearson Corr	Time Elapsed
0	tanh	1	1	118	0.31533211341420664	0.7830793779602233	0.9990526721822146	0.05015052795516559	0.43929481506347656
1	tanh	1	2	85	0.31737770078655420	0.7851092456480440	1.0042387955159695	0.04438758142468731 5	0.40544795989990234
2	tanh	1	3	221	0.29995221465213020	0.7683333136363654	0.9617808800487773	0.1978464231407235	0.8341319561004639
3	tanh	1	4	292	0.29925788135806310	0.7675641441371821	0.9598561887303981	0.20357385194097677	1.137714147567749
4	tanh	1	5	206	0.30014169552798176	0.7685956443570557	0.9624377505468734	0.1986699123978676	0.8432288169860684
5	tanh	2	1	125	0.31553620523303527	0.7835324341080009	1.0002090246621123	0.05266538302803618	0.6229720115661621
6	tanh	2	2	97	0.31532870263499 7	0.7831481711035345	0.9992282124771333	0.05038761999452448 5	0.5292670726776123
7	tanh	2	3	70	0.31499796836369506	0.7833387649748217	0.9997146337055791	0.02170411581871677	0.3781890869140625
8	tanh	2	4	62	0.31472062892344 13	0.7824071777401085	0.9973382222606 34	0.05381238373220904	0.3649039268493 6523
9	tanh	2	5	66	0.31514937830139905	0.7827786371741086	0.9982854493447485	0.04306979698600045 5	0.4041690826416 0156
10	tanh	3	1	106	0.31555509430417 55	0.7835662899774408	1.0002954631457 44	0.05079051406764694	0.6545457839965 82
11	tanh	3	2	77	0.31550963959267514	0.7833515682880988	0.9997473137281127	0.03091796541214336 3	0.5277819633483 887
12	tanh	3	3	70	0.31524649970726 01	0.7829098435067 16	0.9986201348963949	0.05292346754113190 5	0.4722731113433 838
13	tanh	3	4	65	0.31544618865230545	0.7833353724527929	0.9997059744977 76	0.05531691960432784	0.4654059410095 215
14	tanh	3	5	63	0.31540450545970 91	0.7832606548573706	0.9995152718516556	0.03075316452994116 3	0.4900431632995 6055
15	tanh	4	1	174	0.31556481801620 11	0.7835669976418036	1.0002972699457051	0.05426407523629190 5	1.3064410686492 92
16	tanh	4	2	78	0.31554996677472 7	0.7835317843488349	1.0002073657780841	0.01361012514825357 2	0.6479709148406 982
17	tanh	4	3	82	0.31553514971427 69	0.7835255064938 75	1.0001913380131802	0.00344343945737884 14	0.6872949600219 727
18	tanh	4	4	66	0.31551080909514845	0.7834359932676126	0.9999628189958858	0.04998070688644822	0.5818607807159 424
19	tanh	4	5	42	0.31474872837603 4	0.7826540671737967	0.9979677438839673	0.05983207446946079 6	0.4161851406097 412
20	tanh	5	1	142	0.31556666937498 28	0.7835821319593695	1.0003359110900865	0.19400993003893 75	1.2547299861907 96
21	tanh	5	2	72	0.31555058861350 17	0.7835256433945083	1.0001916875278762	0.00014961104014038 52	0.6909518241882 324
22	tanh	5	3	91	0.31555081042490185	0.7835288556226804	1.0001998885370686	0.02067844512026198	0.8888709545135 498
23	tanh	5	4	78	0.31554939036470214	0.7835236950564756	1.0001867133216116	0.02438604892880724 3	0.8292250633239 746
24	tanh	5	5	52	0.31553572932183 43	0.7835112294857371	1.0001548883771 32	-0.0006436003780331517	0.5948829650878 906
25	tanh	6	1	134	0.31555617013439174	0.7835631699329939	1.0002874971060 32	0.04507773785574093 6	1.3491330146789 55

26	tanh	6	2	107	0.3155480508307 4383	0.783537649946 2364	1.000222341139 142	0.0420112573354923	1.1747541427612 305
27	tanh	6	3	76	0.3155467329665 885	0.783522182170 936	1.000182850856 2796	0.0138741689650705 12	0.8574769496917 725
28	tanh	6	4	57	0.3155484205820 8765	0.783499883824 2168	1.000125923031 7838	0.0415032721819759	0.7164762020111 084
29	tanh	6	5	36	0.3154750332270 4484	0.783402312200 2686	0.999876841095 0362	0.0919386307788018 8	0.4891247749328 6133
30	tanh	7	1	103	0.3155532298348 3214	0.783564725630 6674	1.000291469080 5622	0.1272434150072123	1.1822130680084 229
31	tanh	7	2	112	0.3155589295851 626	0.783543568469 2659	1.000237451737 3858	-0.0132302957986434 93	1.3893599510192 87
32	tanh	7	3	62	0.3155455717717 3165	0.783517750123 9469	1.000171535682 4241	0.0465973309398679 95	0.7979061603546 143
33	tanh	7	4	63	0.3155511766367 429	0.783507456134 0672	1.000145255006 5084	0.0242382548469724 06	0.8934657573699 951
34	tanh	7	5	60	0.3155530106418 405	0.783510938029 2028	1.000154144286 6522	0.0616743939085706 4	0.8850591182708 74
35	tanh	8	1	121	0.3155625552618 586	0.783578661105 9053	1.000327049194 106	0.2063277121018439 5	1.5800082683563 232
36	tanh	8	2	117	0.3155544159202 5774	0.783537975123 0741	1.000223171346 1025	0.0060640309424415 395	1.6155250072479 248
37	tanh	8	3	82	0.3155531260711 233	0.783535938815 0518	1.000217972466 441	0.0180539264930982 93	1.1761519908905 03
38	tanh	8	4	61	0.3155538035173 822	0.783498371648 8891	1.000122062496 9782	0.0088476052907622 37	0.9476892948150 635
39	tanh	8	5	58	0.3155523991968 624	0.783498386198 5049	1.000122099641 642	-0.0196030884940647 56	0.9648950099945 068
40	tanh	9	1	123	0.3155570227805 494	0.783564345445 9201	1.000290498400 1455	-1.4427724050047989 e-16	1.7517168521881 104
41	tanh	9	2	110	0.3155572610970 273	0.783547804786 2857	1.000248267560 694	-0.0229244275597957 6	1.6739957332611 084
42	tanh	9	3	78	0.3155594147435 575	0.783523522513 1832	1.000186272810 3914	0.0154492248816222 8	1.2706449031829 834
43	tanh	9	4	73	0.3155541187087 9424	0.783516046739 9771	1.000167186899 4928	0.0198620332323329 42	1.2985150814056 396
44	tanh	9	5	53	0.3155521767102 3345	0.783501921633 9157	1.000131125505 9606	0.0529412060879885 9	1.0030791759490 967
45	tanh	10	1	136	0.3155619291883 922	0.783562713531 2389	1.000286331832 1809	NA	2.0865039825439 453
46	tanh	10	2	91	0.3155522134000 7644	0.783536582457 5066	1.000219615742 7319	-0.0270608850406694 54	1.5261838436126 71
47	tanh	10	3	58	0.3155524076972 048	0.783509191732 4931	1.000149685985 2803	0.0181930899281321 54	1.0103490352630 615
48	tanh	10	4	49	0.3155524993727 0313	0.783494409295 7511	1.000111946772 6431	0.0014434264387457 585	0.9183828830718 994
49	tanh	10	5	54	0.3155526453131 2305	0.783502071962 8482	1.000131509292 2785	0.0709748076159658 6	1.0705928802490 234
50	identity	1	1	138	0.2985652970232 447	0.765859070677 7552	0.955596460033 7773	0.2128571877122628	0.4863290786743 164
51	identity	1	2	113	0.2986021491508 26	0.766110349222 166	0.956223625758 0647	0.2125190024506528 3	0.3992431163787 842
52	identity	1	3	100	0.2986190368913 36	0.765797250812 8356	0.955442195464 5148	0.2125434692372380 5	0.3506863117218 0176
53	identity	1	4	114	0.2986709491429 931	0.765763345226 8945	0.955357593148 962	0.2126629531638918	0.4196019172668 457
54	identity	1	5	108	0.2987039893548 591	0.765974639641 0231	0.955884882875 4483	0.2120039293667581 6	0.4545693397521 9727
55	identity	2	1	112	0.2984998527673 5125	0.765833344688 7988	0.955532262188 4466	0.2124739172956907	0.5303018093109 131

56	identity	2	2	78	0.2986019485906115	0.7657477777850018	0.9553187500188036	0.21302808676116667	0.4002189636230469
57	identity	2	3	74	0.2986906469453911	0.7657420582518563	0.9553044791139237	0.2136436484892981	0.36892008781433105
58	identity	2	4	59	0.2987020707339 6465	0.7660650182405 51	0.9561104690222794	0.21152620456015508	0.36860179901123047
59	identity	2	5	57	0.2987112627914421	0.7660665144264596	0.9561142037455043	0.21223956178570816	0.36226987838745117
60	identity	3	1	89	0.2985254282334371	0.7663350852973818	0.9567847184641475	0.21274908576841006	0.5945918560028076
61	identity	3	2	56	0.2985929705353363	0.7658689121659452	0.9556210195175284	0.2127993323487475	0.39823603630065 92
62	identity	3	3	68	0.2986767513447491	0.7660208104387046	0.9560001224548956	0.21198419541295413	0.41747808456420 9
63	identity	3	4	45	0.2987083318065687	0.7661565844777676	0.9563390466706856	0.2124848099959701	0.3236401081085205
64	identity	3	5	45	0.2988405329624 9274	0.7663939484405872	0.9569317077380 56	0.21325166889710356	0.32068800926208496
65	identity	4	1	98	0.2985823981811197	0.7658054530637332	0.9554626625491534	0.2127854226192168	0.7372000217437744
66	identity	4	2	61	0.2985270256505 9236	0.7658882185656004	0.9556691996527238	0.21245326585590135	0.5726079940795898
67	identity	4	3	50	0.2987087172563 2386	0.7660470921741813	0.9560657232140648	0.21133620187007782	0.3754720687866211
68	identity	4	4	50	0.2987740823980069	0.7668438703348484	0.9580555968449135	0.21233498723189356	0.41500186920166016
69	identity	4	5	48	0.2987241724512554	0.7662926687508599	0.9566788055778526	0.21191239979077153	0.4681861400604248
70	identity	5	1	93	0.2985650192630 76	0.7664949536036 21	0.9571839576744384	0.21235745113729868	0.8182389736175537
71	identity	5	2	53	0.2985448916974 7256	0.7657125155093 15	0.9552307682094359	0.2129652811292437	0.553459882736206
72	identity	5	3	54	0.2987035172941 4957	0.7660707832226377	0.9561248593947296	0.2120678915557676	0.4813349246978 76
73	identity	5	4	48	0.2988664800044 7125	0.7655605817238269	0.9548517292749642	0.21410385077851296	0.4986488819122 3145
74	identity	5	5	45	0.2988653524099244	0.7679364056315171	0.9607874572106437	0.21217716773115364	0.4989569187164 3066
75	identity	6	1	94	0.2985108254095 0336	0.7668268794856724	0.9580131423155335	0.21214321620392718	0.9223818778991699
76	identity	6	2	124	0.2987842226241544	0.7660078120018325	0.9559676784229821	0.2114992923849458	1.2192142009735107
77	identity	6	3	56	0.2985842462857493	0.7656714676861247	0.9551283561633768	0.21301971463234368	0.5737218856811523
78	identity	6	4	56	0.2986072007950 4927	0.7670114275808294	0.9584743175298401	0.2126331805735973	0.6209120750427246
79	identity	6	5	38	0.2990443659259695	0.7659163135174428	0.9557393142515599	0.2134837121277995	0.4699287414550781
80	identity	7	1	102	0.2985097451534188	0.7666725393711777	0.9576275403444315	0.21214161630168035	1.1161859035491943
81	identity	7	2	65	0.2985516882184 8965	0.7669211232526822	0.9582486382741596	0.21309306976165368	0.7647306919097 9
82	identity	7	3	75	0.2987738014306 3414	0.7658874447011007	0.9556672684098203	0.21196404233109445	0.8542468547821045
83	identity	7	4	51	0.2987000358660 8695	0.7656876801496924	0.9551688047063122	0.21355999863499328	0.6160969734191895
84	identity	7	5	34	0.2990066152006 2	0.7658496950349675	0.9555730633631329	0.21206965319113488	0.4574508666992 1875
85	identity	8	1	102	0.2984125341276 74	0.7660585147549139	0.9560942353497823	0.21255242701425775	1.2102992534637451
86	identity	8	2	51	0.2987495994957 6024	0.7664437221385427	0.9570560082405732	0.21267726018924782	0.6895689964294434

87	identity	8	3	42	0.2987668189520 4427	0.765982386999 7219	0.955904219339 4264	0.2125839644614879 5	0.5656900405883 789
88	identity	8	4	55	0.2989868356867 7403	0.765757041018 9968	0.955341863098 3401	0.2134333095143217	0.7521641254425 049
89	identity	8	5	73	0.2989192914203 6855	0.770087661489 6054	0.966177993930 6843	0.2102094383662067	1.0065650939941 406
90	identity	9	1	98	0.2985323820444 1956	0.766244843694 4941	0.956559394830 7177	0.2120994906653575 5	1.2861220836639 404
91	identity	9	2	59	0.2987414605619 0365	0.766395190486 7295	0.956934809417 8165	0.2123747265306561 7	0.8043279647827 148
92	identity	9	3	45	0.2989912378982 9857	0.768792865066 6146	0.962931734634 1147	0.2127617594122018 2	0.6349887847900 391
93	identity	9	4	42	0.2990944094538 129	0.768107839715 4486	0.961216477378 172	0.2109335383172656	0.6276748180389 404
94	identity	9	5	37	0.2989627502312 2476	0.766078103598 4932	0.956143132449 7268	0.2110536927436313	0.5918908119201 66
95	identity	10	1	89	0.2986570309577 5165	0.766019344287 3889	0.955996462921 1678	0.2117739059209286	1.2702288627624 512
96	identity	10	2	52	0.2986750735128 4106	0.766051494454 9409	0.956076711786 1118	0.2133318231328195 4	0.7965550422668 457
97	identity	10	3	42	0.2987788889820 793	0.765844090126 7961	0.955559076598 6093	0.2127155276174166 6	0.6372270584106 445
98	identity	10	4	89	0.2992970723735 5235	0.769376926046 8344	0.964395391526 4967	0.2116208211068992 8	1.4117071628570 557
99	identity	10	5	46	0.2989431664521 3986	0.767052391613 7575	0.958576699373 3367	0.2134536171439411 5	0.7828869819641 113
100	relu	1	1	215	0.3155734652881 302	0.783623913998 2705	1.000442593431 5235	-1.4188854446570373e-16	0.7830021381378 174
101	relu	1	2	113	0.2985926672263 4387	0.766109937512 8302	0.956222598005 1086	0.2125275594860472 4	0.4254508018493 6523
102	relu	1	3	96	0.2986308937941 356	0.765973168836 0013	0.955881211947 2911	0.2119157709178364 8	0.3498229980468 75
103	relu	1	4	114	0.2987533599621 2454	0.765838035275 0692	0.955543967137 7458	0.2123183024394453 8	0.4436230659484 8633
104	relu	1	5	172	0.3017700557738 0595	0.768840017809 2256	0.963049858167 0398	0.2048878328843621 3	0.6829769611358 643
105	relu	2	1	64	0.3155395503234 133	0.783496936535 5351	1.000118398705 7949	1.4188854446570373e-16	0.3388719558715 8203
106	relu	2	2	77	0.2986423251828 1447	0.766149319648 0264	0.956320910410 9436	0.2125339620430456 7	0.4005091190338 135
107	relu	2	3	74	0.2986791207294 031	0.765754524498 872	0.955335583996 8879	0.2134701891960618 7	0.3802239894866 9434
108	relu	2	4	164	0.2987682837607 044	0.769090141855 9991	0.963676571409 9207	0.2158400874274702	0.8897619247436 523
109	relu	2	5	117	0.3006682138712 166	0.768826325180 3584	0.963015555668 3168	0.2077829561501560 7	0.6784451007843 018
110	relu	3	1	31	0.3155362585538 044	0.783470409947 0323	1.000050678517 3031	1.4188854446570373e-16	0.2184419631958 0078
111	relu	3	2	98	0.2984334612678 004	0.766372505722 71	0.956878161048 0596	0.2124787481713404 6	0.6455790996551 514
112	relu	3	3	72	0.2986731074532 195	0.766960633904 7174	0.958347375947 7855	0.2090019383368617	0.4777739048004 1504
113	relu	3	4	94	0.2989415816491 247	0.765790784288 4973	0.955426059694 5874	0.2147587856000856	0.6651530265808 105
114	relu	3	5	96	0.3004893132386 9127	0.767044127906 6336	0.958556045361 913	0.2118292043029338 4	0.7040770053863 525
115	relu	4	1	34	0.3155447836664 146	0.783500224452 4598	1.000126792645 7227	-1.4188854446570373e-16	0.2925188541412 3535
116	relu	4	2	61	0.2984376440039 889	0.765757638430 3559	0.955343353733 8103	0.2134686580916006 5	0.5027382373809 814
117	relu	4	3	57	0.2987218903168 23	0.766277728307 1014	0.956641501119 2955	0.210507709159109	0.4596199989318 8477

118	relu	4	4	67	0.2980169204496 6394	0.766572124894 0456	0.957376707383 5892	0.2112858304503306 4	0.5986561775207 52
119	relu	4	5	99	0.2972615182987 3126	0.772333526353 8937	0.971821687362 4557	0.1999182429032056 7	0.8658471107482 91
120	relu	5	1	241	0.3155807082963 0214	0.783621034513 2331	1.000435241041 8522	NA	2.0711460113525 39
121	relu	5	2	118	0.2985110411086 4446	0.767450117912 7926	0.959571025207 9488	0.2092003385568631 2	1.0654511451721 191
122	relu	5	3	56	0.3154687215979 5564	0.783325448633 4816	0.999680644762 9982	0.0440874017568355 6	0.5363488197326 66
123	relu	5	4	96	0.2990190034845 715	0.765831284429 764	0.955527121014 2161	0.2134737374621291	0.9474108219146 729
124	relu	5	5	77	0.2973190087679 1495	0.768562905851 8457	0.962355761785 9944	0.2001062780203492 5	0.8133368492126 465
125	relu	6	1	236	0.3155804084427 203	0.783629432445 6782	1.000456684143 094	-1.4188854446570373e-16	2.3258366584777 83
126	relu	6	2	81	0.2996336496053 4383	0.767025515625 7615	0.958509527313 617	0.2061912736149720 8	0.9195270538330 078
127	relu	6	3	31	0.3155421314677 829	0.783494100169 7717	1.000111157588 9035	0.0013458795942382 523	0.3467791080474 8535
128	relu	6	4	66	0.2978247480152 131	0.766689085155 1775	0.957668874469 7474	0.2094115106740237 8	0.7745759487152 1
129	relu	6	5	79	0.2978183435170 8375	0.766436815762 5705	0.957038760375 7965	0.2119226669423488	0.9558956623077 393
130	relu	7	1	62	0.3155362792542 208	0.783497637692 2497	1.000120188732 0519	NA	0.7229173183441 162
131	relu	7	2	261	0.3155783481722 726	0.783632698206 4435	1.000465022928 901	NA	3.0555350780487 06
132	relu	7	3	96	0.2986444186859 8973	0.768085944427 6649	0.961161678272 2608	0.2011425679182905 8	1.2059850692749 023
133	relu	7	4	89	0.2976852679462 7836	0.769467680927 2712	0.964622923046 0501	0.1959989197675589 8	1.1735360622406 006
134	relu	7	5	65	0.2987949647146 5794	0.771123905895 3282	0.968779957851 5978	0.2098137363064249 7	0.8915572166442 871
135	relu	8	1	88	0.3155363438920 715	0.783508509065 5631	1.000147943137 014	1.4188854446570373e-16	1.1211779117584 229
136	relu	8	2	83	0.2982808806931 4096	0.771230728164 8886	0.969048382785 528	0.2085465290999434 5	1.1099047660827 637
137	relu	8	3	252	0.3155836216349 373	0.783635968233 7204	1.000473372643 6283	-1.4188854446570373e-16	3.5067572593688 965
138	relu	8	4	66	0.2979737979558 8047	0.767552770226 4893	0.959827742279 9887	0.2047785025251522 3	0.9839968681335 449
139	relu	8	5	76	0.2968774089319 817	0.767488973752 2455	0.959668193429 5519	0.2063969359618902 7	1.1724572181701 66
140	relu	9	1	196	0.3155809476863 17	0.783637187531 9811	1.000476486018 8218	NA	2.7114219665527 344
141	relu	9	2	74	0.2983337418144 435	0.767237798801 5247	0.959040157910 3892	0.2056504596301957 4	1.0919759273529 053
142	relu	9	3	98	0.2982200929150 964	0.767468456573 6098	0.959616884756 0778	0.2036823154133479 4	1.5254368782043 457
143	relu	9	4	42	0.2987720557161 0954	0.766460177238 1531	0.957097103550 1137	0.2096377209279027 5	0.7037339210510 254
144	relu	9	5	57	0.2989891554652 955	0.767484310407 2836	0.959656531372 1366	0.2051689523147316 5	0.9646749496459 961
145	relu	10	1	61	0.3155354180968 1074	0.783497671349 4402	1.000120274657 6114	1.4427724050047989e-16	0.9482662677764 893
146	relu	10	2	215	0.3155720648521 556	0.783615167991 043	1.000420261725 7962	-1.4188854446570373e-16	3.3939547538757 324
147	relu	10	3	32	0.3155420603128 1046	0.783485906853 7946	1.000090240561 2464	1.4188854446570373e-16	0.5491220951080 322

148	relu	10	4	228	0.3155772402873 7233	0.783633594613 5934	1.000467311818 8738	- 1.4188854446570373 e-16	3.9250559806823 73
149	relu	10	5	44	0.2990752921195 134	0.766951271980 7163	0.958323979908 5488	0.2115919631630373	0.8268890380859 375

b) (The Python code for this is in the file: 3_b.py)

Output Screenshot :

```
Unnamed: 0                73
Activation Function    identity
nLayer                        5
nHiddenNeuron                 4
N Iteration                  48
Loss                   0.298866
RMSE                   0.765561
RelErr                 0.954852
Pearson Corr           0.214104
Time Elapsed           0.498649
Name: 73, dtype: object
```

Answer :

The Network Structure that has lowest RMSE is,

Activation Function : Identity
nLayer : 5
nHiddenNeuron : 4

c) (The Python code for this is in the file: 3_c.py)

Output Screenshot:

```
Minimum Severity Combination :
f_primary_age_tier           > 60
f_primary_gender             Male
f_marital               Un-Married
f_residence_location      Suburban
f_fire_alarm_type       Standalone
f_mile_fire_station       < 1 mile
f_aoi_tier               601K - 1M
Severity                  1.153732
Name: A19796, dtype: object

Maximum Severity Combination :
f_primary_age_tier          21 - 27
f_primary_gender               Male
f_marital               Not Married
f_residence_location       Suburban
f_fire_alarm_type              None
f_mile_fire_station       < 1 mile
f_aoi_tier              351K - 600K
Severity                   9.29822
Name: A21048, dtype: object
```

Answer :

Minimum Severity Combination :

f_primary_age_tier	> 60
f_primary_gender	Male
f_marital	Un-Married
f_residence_location	Suburban
f_fire_alarm_type	Standalone
f_mile_fire_station	< 1 mile
f_aoi_tier	601K - 1M
Severity	1.153732

Maximum Severity Combination :

f_primary_age_tier	21 - 27
f_primary_gender	Male
f_marital	Not Married
f_residence_location	Suburban
f_fire_alarm_type	None
f_mile_fire_station	< 1 mile
f_aoi_tier	351K - 600K
Severity	9.29822