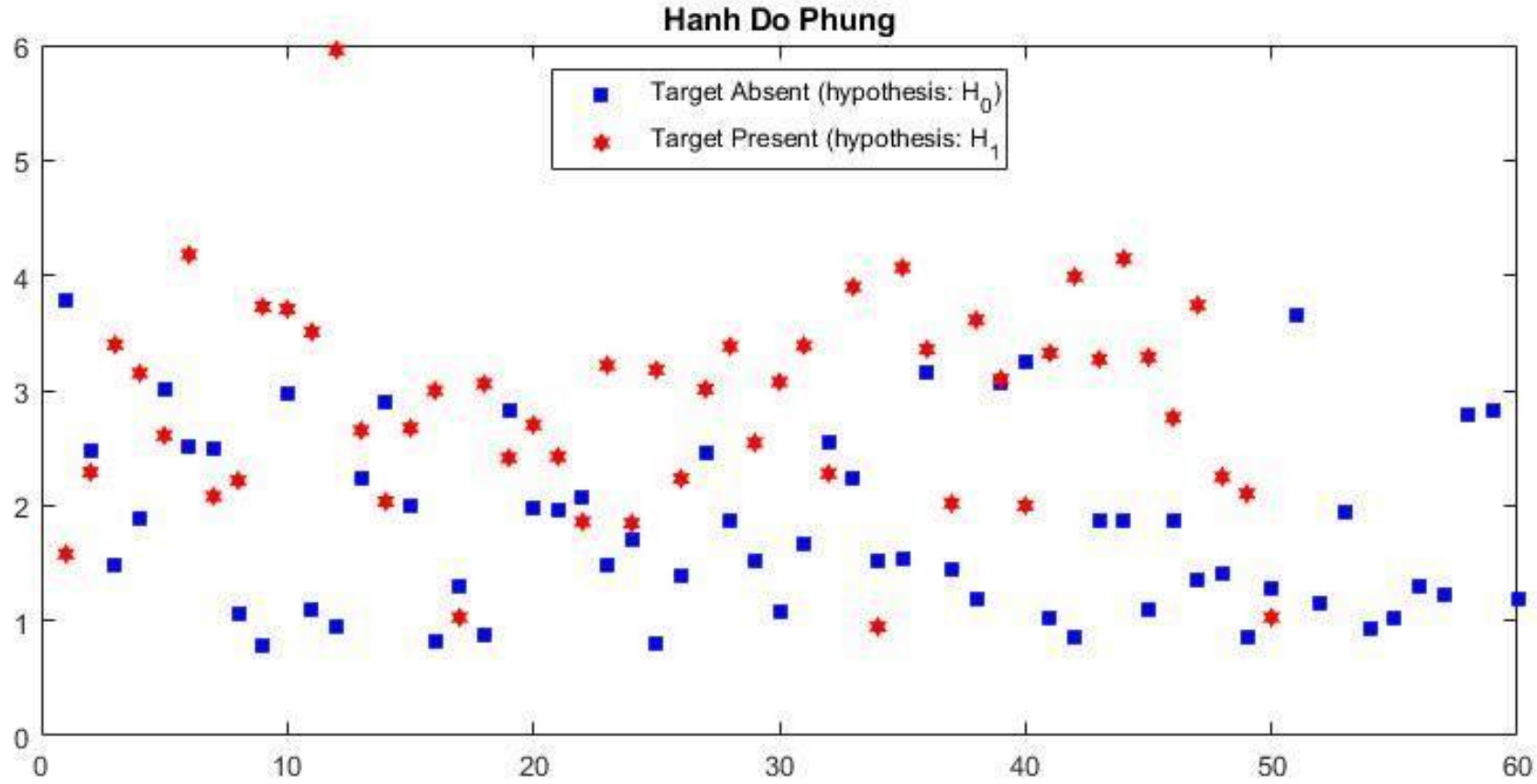
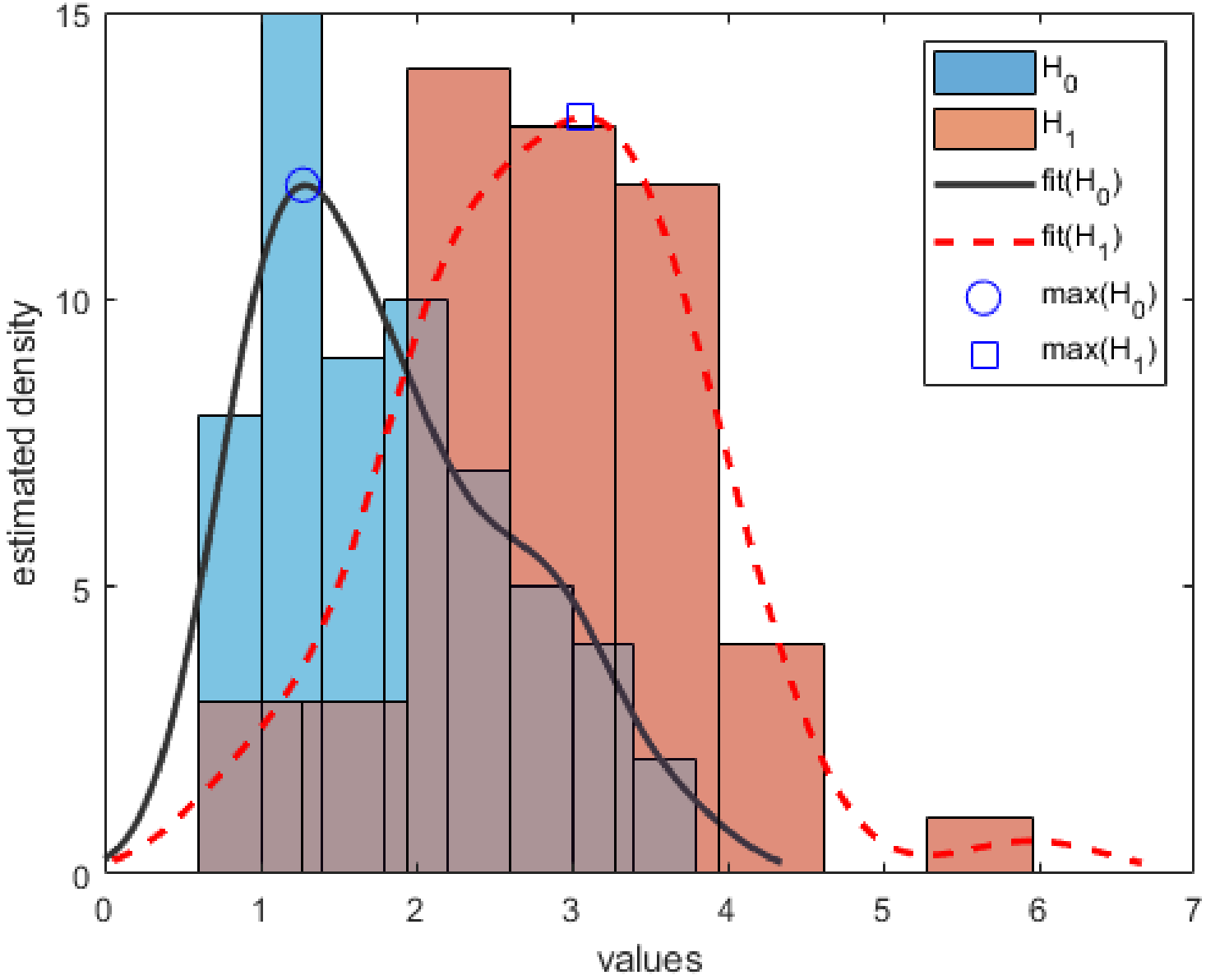
ECE 361 – Homework 2

Part 2

Original data set




15
10
5
0
estimated density
0
1
2
3
4
5
6
7
values
H0
H1
fit(H0)
fit(H1)
max(H0)
max(H1)

Sorted data by midpoint

Target Absent(H_0)				
3.7759	2.5204	1.8734	1.4122	1.0788
3.6511	2.4979	1.8731	1.3817	1.0657
3.2561	2.4831	1.8712	1.3527	1.028
3.1619	2.4502	1.8613	1.2963	1.0277
3.068	2.2434	1.6942	1.2911	0.9464
3.0139	2.2271	1.6655	1.2879	0.9357
2.9679	2.069	1.533	1.2261	0.8722
2.8911	1.989	1.5234	1.1949	0.857
2.8323	1.9848	1.5186	1.1842	0.8473
2.8162	1.9589	1.4885	1.1428	0.8257
2.7888	1.9357	1.4842	1.1034	0.8085
2.5416	1.8819	1.4478	1.0908	0.7763

Target Present(H_1)				
5.958	3.5086	3.1498	2.6094	2.0796
4.1791	3.3986	3.0987	2.545	2.0335
4.1458	3.3897	3.0743	2.4247	2.0194
4.0671	3.3838	3.0576	2.4144	1.999
3.9902	3.3575	3.0119	2.2883	1.8586
3.8993	3.3247	2.9985	2.2781	1.8454
3.7418	3.289	2.7622	2.2485	1.5792
3.7276	3.271	2.7008	2.2346	1.028
3.707	3.2181	2.6743	2.2165	1.0277
3.6119	3.1785	2.6524	2.1027	0.9464

Sorted data by intersection

Target Absent(H_0)				
3.7759	2.5204	1.8734	1.4122	1.0788
3.6511	2.4979	1.8731	1.3817	1.0657
3.2561	2.4831	1.8712	1.3527	1.028
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Mid point probabilities calculation

	Target Not Detected (D_n)	Target Detected (D_p)	Total Samples
Target Absent	42	18	60
Target Present	11	39	50
Total Decisions	53	57	110

ERROR RATE = $\frac{N_F + (N_1 - N_C)}{N} = 0.26364 = \frac{29}{110}$ PPV = $\frac{NC}{NF+NC} = \frac{39}{24}$

$$Tx = \begin{bmatrix} P(D_n|H_0) & P(D_n|H_1) \\ P(D_p|H_0) & P(D_p|H_1) \end{bmatrix}$$

$$Tx = \begin{bmatrix} 1-P_F & P_M \\ P_F & 1-P_M \end{bmatrix} = \begin{bmatrix} 42 & 11 \\ 18 & 39 \end{bmatrix} \begin{bmatrix} 1/60 & 0 \\ 0 & 1/50 \end{bmatrix} = \begin{bmatrix} 42/60 & 11/50 \\ 18/60 & 39/50 \end{bmatrix}$$

$$a\ priori\ prob \rightarrow \begin{bmatrix} P(H_0) \\ P(H_1) \end{bmatrix} = \frac{1}{N} \begin{bmatrix} N_0 \\ N_1 \end{bmatrix} = \frac{1}{110} \begin{bmatrix} 60 \\ 50 \end{bmatrix}$$

$$\begin{bmatrix} P(D_n) \\ P(D_p) \end{bmatrix} = T_X \begin{bmatrix} P(H_0) \\ P(H_1) \end{bmatrix} = \frac{1}{110} \begin{bmatrix} 53 \\ 57 \end{bmatrix}$$

Intersection point probabilities calculation

	Target Not Detected (D_n)	Target Detected (D_p)	Total Samples
Target Absent	37	23	60
Target Present	6	44	50
Total Decisions	43	67	110

ERROR RATE = $\frac{N_F + (N_1 - N_C)}{N} = 0.26364 = \frac{29}{110}$ PPV = $\frac{NC}{NF+NC} = \frac{44}{67}$

$$Tx = \begin{bmatrix} P(D_n|H_0) & P(D_n|H_1) \\ P(D_p|H_0) & P(D_p|H_1) \end{bmatrix}$$

$$Tx = \begin{bmatrix} 1-P_F & P_M \\ P_F & 1-P_M \end{bmatrix} = \begin{bmatrix} 37 & 6 \\ 23 & 44 \end{bmatrix} \begin{bmatrix} 1/60 & 0 \\ 0 & 1/50 \end{bmatrix} = \begin{bmatrix} 37/60 & 6/50 \\ 23/60 & 44/50 \end{bmatrix}$$

$$a\ priori\ prob \rightarrow \begin{bmatrix} P(H_0) \\ P(H_1) \end{bmatrix} = \frac{1}{N} \begin{bmatrix} N_0 \\ N_1 \end{bmatrix} = \frac{1}{110} \begin{bmatrix} 60 \\ 50 \end{bmatrix}$$

$$\begin{bmatrix} P(D_n) \\ P(D_p) \end{bmatrix} = T_X \begin{bmatrix} P(H_0) \\ P(H_1) \end{bmatrix} = \frac{1}{110} \begin{bmatrix} 43 \\ 67 \end{bmatrix}$$