

CSE 4309 Assignment 2

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Task 1:

Part a:

Given:

$$P(M) = 0.05, \quad P(D | M) = 0.8, \quad P(D | S) = 0.1, \quad P(S) = 0.95,$$

$$P(M | D) = \frac{P(D | M) * P(M)}{P(D)}$$

Thus,

$$P(M | D) = \frac{0.8 * 0.05}{(0.8 * 0.05) + (0.1 * 0.95)} = 0.296$$

Part b:

$$P(M || T \leq 80) = 0.296$$

So

$$P(S || T \leq 80) = 0.704$$

Thus:

$$P(T \leq 80) = (P(T \leq 80 || M) * P(M || T \leq 80)) + (P(T \leq 80 || S) * P(S || T \leq 80))$$

Computing the Expression we get:

$$P(T \leq 80) = (0.8 * 0.296) + (0.1 * 0.704) = 0.307$$

Part c:

$$P(\text{first three under } 80) = P((T \leq 80)^3) = (P(T \leq 80 || M)^3 * P(M)) + (P(T \leq 80 || S)^3 * P(S)) =$$

Solving this we get:

$$P(\text{first three under } 80) = ((0.8)^3 * 0.05) + ((0.1)^3 * 0.95) = 0.0266$$

Task 2:

To be a valid probability function, the following conditions must be satisfied:

1. $P(s) \geq 0$ for all $s \in S$.
2. $\sum_{s \in S} P(s) = 1$.

The sum of probabilities $P(A) + P(B) = 0.9$ satisfies the first condition, indicating that $P(C)$ and $P(D)$ could potentially satisfy the second condition if $P(C) + P(D) = 0.1$ and each is non-negative. Thus, P is POSSIBLY a probability function.

Task 3:

Given:

- $P(x) = 0.3$ for $0 \leq x \leq 10$

The function satisfies the first condition that the probability is positive. However, calculating the integral:

$$\int_0^{10} P(x) dx = \int_0^{10} 0.3 dx = 3$$

Since this integral equals 3, not 1, $P(x)$ does not satisfy the second condition and is DEFINITELY NOT a probability function.

Task 4:

Marginal Probabilities:

$$\begin{aligned} p(F = a) &= p(F = a \mid B = r) \times p(B = r) + p(F = a \mid B = b) \times p(B = b) \\ &= 0.25 \times 0.4 + 0.75 \times 0.6 = 0.55 \\ p(F = o) &= p(F = o \mid B = r) \times p(B = r) + p(F = o \mid B = b) \times p(B = b) \\ &= 0.75 \times 0.4 + 0.25 \times 0.6 = 0.45 \end{aligned}$$

Posterior Probabilities:

$$\begin{aligned} p(B = r \mid F = a) &= \frac{p(F = a \mid B = r) \times p(B = r)}{p(F = a)} = \frac{0.25 \times 0.4}{0.55} = 0.182 \\ p(B = b \mid F = a) &= \frac{p(F = a \mid B = b) \times p(B = b)}{p(F = a)} = \frac{0.75 \times 0.6}{0.55} = 0.818 \\ p(B = r \mid F = o) &= \frac{p(F = o \mid B = r) \times p(B = r)}{p(F = o)} = \frac{0.75 \times 0.4}{0.45} = 0.667 \\ p(B = b \mid F = o) &= \frac{p(F = o \mid B = b) \times p(B = b)}{p(F = o)} = \frac{0.25 \times 0.6}{0.45} = 0.333 \end{aligned}$$

Classifier Accuracy:

The Bayesian classifier chooses Blue box with probability 0.818.

Task 5:

Python file is attached to this document.

For yeast dataset:

```
Class 1, attribute 1, mean = 0.52, std = 0.10
Class 1, attribute 2, mean = 0.54, std = 0.10
Class 1, attribute 3, mean = 0.52, std = 0.07
Class 1, attribute 4, mean = 0.41, std = 0.17
Class 1, attribute 5, mean = 0.50, std = 0.01
Class 1, attribute 6, mean = 0.00, std = 0.01
Class 1, attribute 7, mean = 0.50, std = 0.05
Class 1, attribute 8, mean = 0.24, std = 0.05
Class 2, attribute 1, mean = 0.45, std = 0.11
Class 2, attribute 2, mean = 0.45, std = 0.10
Class 2, attribute 3, mean = 0.53, std = 0.06
Class 2, attribute 4, mean = 0.23, std = 0.11
Class 2, attribute 5, mean = 0.50, std = 0.04
Class 2, attribute 6, mean = 0.00, std = 0.01
Class 2, attribute 7, mean = 0.49, std = 0.06
Class 2, attribute 8, mean = 0.33, std = 0.14
Class 3, attribute 1, mean = 0.43, std = 0.10
Class 3, attribute 2, mean = 0.48, std = 0.11
Class 3, attribute 3, mean = 0.36, std = 0.06
Class 3, attribute 4, mean = 0.22, std = 0.08
Class 3, attribute 5, mean = 0.51, std = 0.05
Class 3, attribute 6, mean = 0.00, std = 0.01
Class 3, attribute 7, mean = 0.51, std = 0.04
Class 3, attribute 8, mean = 0.27, std = 0.09
Class 4, attribute 1, mean = 0.79, std = 0.07
Class 4, attribute 2, mean = 0.76, std = 0.07
Class 4, attribute 3, mean = 0.38, std = 0.06
Class 4, attribute 4, mean = 0.32, std = 0.11
Class 4, attribute 5, mean = 0.50, std = 0.01
Class 4, attribute 6, mean = 0.00, std = 0.01
Class 4, attribute 7, mean = 0.51, std = 0.07
Class 4, attribute 8, mean = 0.27, std = 0.09
Class 5, attribute 1, mean = 0.74, std = 0.16
Class 5, attribute 2, mean = 0.62, std = 0.13
Class 5, attribute 3, mean = 0.42, std = 0.08
Class 5, attribute 4, mean = 0.30, std = 0.12
Class 5, attribute 5, mean = 0.50, std = 0.01
Class 5, attribute 6, mean = 0.00, std = 0.01
Class 5, attribute 7, mean = 0.51, std = 0.06
Class 5, attribute 8, mean = 0.24, std = 0.04
```

```

Class 6, attribute 1, mean = 0.54, std = 0.14
Class 6, attribute 2, mean = 0.50, std = 0.12
Class 6, attribute 3, mean = 0.51, std = 0.05
Class 6, attribute 4, mean = 0.24, std = 0.10
Class 6, attribute 5, mean = 0.50, std = 0.01
Class 6, attribute 6, mean = 0.49, std = 0.39
Class 6, attribute 7, mean = 0.51, std = 0.03
Class 6, attribute 8, mean = 0.24, std = 0.05
Class 7, attribute 1, mean = 0.48, std = 0.11
Class 7, attribute 2, mean = 0.47, std = 0.09
Class 7, attribute 3, mean = 0.54, std = 0.06
Class 7, attribute 4, mean = 0.22, std = 0.12
Class 7, attribute 5, mean = 0.50, std = 0.04
Class 7, attribute 6, mean = 0.00, std = 0.03
Class 7, attribute 7, mean = 0.50, std = 0.06
Class 7, attribute 8, mean = 0.26, std = 0.09
Class 8, attribute 1, mean = 0.74, std = 0.11
Class 8, attribute 2, mean = 0.73, std = 0.11
Class 8, attribute 3, mean = 0.49, std = 0.05
Class 8, attribute 4, mean = 0.29, std = 0.07
Class 8, attribute 5, mean = 0.50, std = 0.01
Class 8, attribute 6, mean = 0.00, std = 0.01
Class 8, attribute 7, mean = 0.46, std = 0.08
Class 8, attribute 8, mean = 0.23, std = 0.02
Class 9, attribute 1, mean = 0.55, std = 0.14
Class 9, attribute 2, mean = 0.56, std = 0.16
Class 9, attribute 3, mean = 0.51, std = 0.07
Class 9, attribute 4, mean = 0.20, std = 0.07
Class 9, attribute 5, mean = 0.50, std = 0.01
Class 9, attribute 6, mean = 0.00, std = 0.01
Class 9, attribute 7, mean = 0.53, std = 0.05
Class 9, attribute 8, mean = 0.24, std = 0.05
Class 10, attribute 1, mean = 0.78, std = 0.06
Class 10, attribute 2, mean = 0.73, std = 0.12
Class 10, attribute 3, mean = 0.48, std = 0.11
Class 10, attribute 4, mean = 0.33, std = 0.07
Class 10, attribute 5, mean = 1.00, std = 0.01
Class 10, attribute 6, mean = 0.00, std = 0.01
Class 10, attribute 7, mean = 0.55, std = 0.02
Class 10, attribute 8, mean = 0.23, std = 0.01
classification accuracy for yeast dataset = 0.4483

```

for pendigits dataset:

```

Class 0, attribute 1, mean = 33.88, std = 22.65

```

Class 0, attribute 2, mean = 85.92, std = 15.07
 Class 0, attribute 3, mean = 10.43, std = 12.49
 Class 0, attribute 4, mean = 56.75, std = 21.73
 Class 0, attribute 5, mean = 15.70, std = 18.53
 Class 0, attribute 6, mean = 17.26, std = 17.51
 Class 0, attribute 7, mean = 53.60, std = 26.84
 Class 0, attribute 8, mean = 6.42, std = 11.78
 Class 0, attribute 9, mean = 88.01, std = 15.27
 Class 0, attribute 10, mean = 32.95, std = 22.79
 Class 0, attribute 11, mean = 88.73, std = 16.37
 Class 0, attribute 12, mean = 70.92, std = 22.56
 Class 0, attribute 13, mean = 56.59, std = 25.51
 Class 0, attribute 14, mean = 90.38, std = 12.89
 Class 0, attribute 15, mean = 19.15, std = 19.34
 Class 0, attribute 16, mean = 73.60, std = 23.43
 Class 1, attribute 1, mean = 11.56, std = 22.24
 Class 1, attribute 2, mean = 59.07, std = 17.99
 Class 1, attribute 3, mean = 42.51, std = 21.51
 Class 1, attribute 4, mean = 75.22, std = 15.87
 Class 1, attribute 5, mean = 72.23, std = 19.88
 Class 1, attribute 6, mean = 89.65, std = 10.78
 Class 1, attribute 7, mean = 81.78, std = 22.86
 Class 1, attribute 8, mean = 83.27, std = 20.52
 Class 1, attribute 9, mean = 72.24, std = 22.53
 Class 1, attribute 10, mean = 57.80, std = 27.33
 Class 1, attribute 11, mean = 53.67, std = 30.80
 Class 1, attribute 12, mean = 35.73, std = 21.23
 Class 1, attribute 13, mean = 46.87, std = 25.53
 Class 1, attribute 14, mean = 17.40, std = 10.37
 Class 1, attribute 15, mean = 58.56, std = 36.36
 Class 1, attribute 16, mean = 1.31, std = 3.08
 Class 2, attribute 1, mean = 20.18, std = 18.77
 Class 2, attribute 2, mean = 77.57, std = 9.86
 Class 2, attribute 3, mean = 43.99, std = 19.81
 Class 2, attribute 4, mean = 99.47, std = 2.27
 Class 2, attribute 5, mean = 69.73, std = 17.22
 Class 2, attribute 6, mean = 79.11, std = 12.30
 Class 2, attribute 7, mean = 53.56, std = 18.68
 Class 2, attribute 8, mean = 45.47, std = 14.12
 Class 2, attribute 9, mean = 21.04, std = 18.83
 Class 2, attribute 10, mean = 19.26, std = 13.01
 Class 2, attribute 11, mean = 10.02, std = 12.92
 Class 2, attribute 12, mean = 9.59, std = 8.64
 Class 2, attribute 13, mean = 52.23, std = 11.99
 Class 2, attribute 14, mean = 6.00, std = 6.62
 Class 2, attribute 15, mean = 98.52, std = 6.24

Class 2, attribute 16, mean = 3.12, std = 5.74
 Class 3, attribute 1, mean = 25.08, std = 19.73
 Class 3, attribute 2, mean = 84.12, std = 6.96
 Class 3, attribute 3, mean = 56.15, std = 19.44
 Class 3, attribute 4, mean = 99.66, std = 1.48
 Class 3, attribute 5, mean = 86.59, std = 13.33
 Class 3, attribute 6, mean = 84.71, std = 8.68
 Class 3, attribute 7, mean = 64.19, std = 16.23
 Class 3, attribute 8, mean = 60.68, std = 8.15
 Class 3, attribute 9, mean = 80.34, std = 17.18
 Class 3, attribute 10, mean = 42.97, std = 7.18
 Class 3, attribute 11, mean = 91.19, std = 11.86
 Class 3, attribute 12, mean = 17.06, std = 8.23
 Class 3, attribute 13, mean = 50.07, std = 11.70
 Class 3, attribute 14, mean = 2.17, std = 4.09
 Class 3, attribute 15, mean = 3.18, std = 9.76
 Class 3, attribute 16, mean = 5.88, std = 6.79
 Class 4, attribute 1, mean = 39.51, std = 23.88
 Class 4, attribute 2, mean = 99.45, std = 2.99
 Class 4, attribute 3, mean = 20.87, std = 17.41
 Class 4, attribute 4, mean = 78.94, std = 9.61
 Class 4, attribute 5, mean = 5.64, std = 10.55
 Class 4, attribute 6, mean = 50.21, std = 10.86
 Class 4, attribute 7, mean = 41.71, std = 31.09
 Class 4, attribute 8, mean = 39.33, std = 11.11
 Class 4, attribute 9, mean = 85.80, std = 19.47
 Class 4, attribute 10, mean = 48.24, std = 18.53
 Class 4, attribute 11, mean = 88.03, std = 13.59
 Class 4, attribute 12, mean = 60.06, std = 15.52
 Class 4, attribute 13, mean = 71.75, std = 17.40
 Class 4, attribute 14, mean = 32.15, std = 7.08
 Class 4, attribute 15, mean = 62.94, std = 25.86
 Class 4, attribute 16, mean = 0.00, std = 0.01
 Class 5, attribute 1, mean = 39.42, std = 28.51
 Class 5, attribute 2, mean = 90.31, std = 8.15
 Class 5, attribute 3, mean = 39.83, std = 34.42
 Class 5, attribute 4, mean = 74.24, std = 20.21
 Class 5, attribute 5, mean = 57.41, std = 23.26
 Class 5, attribute 6, mean = 57.01, std = 29.41
 Class 5, attribute 7, mean = 36.81, std = 24.32
 Class 5, attribute 8, mean = 27.39, std = 33.53
 Class 5, attribute 9, mean = 23.49, std = 26.69
 Class 5, attribute 10, mean = 31.56, std = 21.47
 Class 5, attribute 11, mean = 34.97, std = 37.16
 Class 5, attribute 12, mean = 51.80, std = 21.65
 Class 5, attribute 13, mean = 42.62, std = 14.02

Class 5, attribute 14, mean = 61.85, std = 44.04
 Class 5, attribute 15, mean = 63.88, std = 47.41
 Class 5, attribute 16, mean = 64.35, std = 45.60
 Class 6, attribute 1, mean = 85.52, std = 18.80
 Class 6, attribute 2, mean = 99.06, std = 3.49
 Class 6, attribute 3, mean = 49.58, std = 18.22
 Class 6, attribute 4, mean = 86.37, std = 8.47
 Class 6, attribute 5, mean = 19.46, std = 14.29
 Class 6, attribute 6, mean = 57.44, std = 9.21
 Class 6, attribute 7, mean = 7.17, std = 9.66
 Class 6, attribute 8, mean = 25.47, std = 10.61
 Class 6, attribute 9, mean = 35.77, std = 22.34
 Class 6, attribute 10, mean = 2.51, std = 5.23
 Class 6, attribute 11, mean = 84.56, std = 21.99
 Class 6, attribute 12, mean = 11.91, std = 10.77
 Class 6, attribute 13, mean = 60.59, std = 16.93
 Class 6, attribute 14, mean = 30.23, std = 9.24
 Class 6, attribute 15, mean = 10.38, std = 12.64
 Class 6, attribute 16, mean = 21.23, std = 13.75
 Class 7, attribute 1, mean = 3.33, std = 8.40
 Class 7, attribute 2, mean = 91.64, std = 7.33
 Class 7, attribute 3, mean = 46.54, std = 20.03
 Class 7, attribute 4, mean = 99.00, std = 2.50
 Class 7, attribute 5, mean = 81.45, std = 16.90
 Class 7, attribute 6, mean = 81.10, std = 12.30
 Class 7, attribute 7, mean = 71.54, std = 17.52
 Class 7, attribute 8, mean = 47.37, std = 20.39
 Class 7, attribute 9, mean = 52.06, std = 20.30
 Class 7, attribute 10, mean = 14.00, std = 23.32
 Class 7, attribute 11, mean = 33.92, std = 26.74
 Class 7, attribute 12, mean = 16.93, std = 17.11
 Class 7, attribute 13, mean = 37.25, std = 21.39
 Class 7, attribute 14, mean = 33.89, std = 8.97
 Class 7, attribute 15, mean = 80.49, std = 28.38
 Class 7, attribute 16, mean = 34.79, std = 15.17
 Class 8, attribute 1, mean = 53.98, std = 30.27
 Class 8, attribute 2, mean = 80.08, std = 18.10
 Class 8, attribute 3, mean = 40.50, std = 27.93
 Class 8, attribute 4, mean = 78.70, std = 20.74
 Class 8, attribute 5, mean = 54.59, std = 35.22
 Class 8, attribute 6, mean = 53.63, std = 29.38
 Class 8, attribute 7, mean = 48.43, std = 30.42
 Class 8, attribute 8, mean = 26.90, std = 29.19
 Class 8, attribute 9, mean = 34.72, std = 28.46
 Class 8, attribute 10, mean = 19.13, std = 19.42
 Class 8, attribute 11, mean = 43.99, std = 35.23

Class 8, attribute 12, mean = 36.05, std = 26.70
Class 8, attribute 13, mean = 67.80, std = 29.50
Class 8, attribute 14, mean = 66.99, std = 30.11
Class 8, attribute 15, mean = 43.21, std = 38.17
Class 8, attribute 16, mean = 79.06, std = 20.38
Class 9, attribute 1, mean = 67.83, std = 30.67
Class 9, attribute 2, mean = 80.35, std = 20.00
Class 9, attribute 3, mean = 52.67, std = 26.93
Class 9, attribute 4, mean = 81.01, std = 20.51
Class 9, attribute 5, mean = 46.93, std = 34.84
Class 9, attribute 6, mean = 81.10, std = 15.76
Class 9, attribute 7, mean = 52.30, std = 30.67
Class 9, attribute 8, mean = 83.90, std = 14.72
Class 9, attribute 9, mean = 75.07, std = 29.97
Class 9, attribute 10, mean = 72.13, std = 13.05
Class 9, attribute 11, mean = 87.79, std = 14.29
Class 9, attribute 12, mean = 46.53, std = 20.41
Class 9, attribute 13, mean = 61.92, std = 17.25
Class 9, attribute 14, mean = 16.82, std = 17.79
Class 9, attribute 15, mean = 20.70, std = 30.63
Class 9, attribute 16, mean = 4.80, std = 12.12
classification accuracy for pendigits dataset = 0.1023

for satellite dataset:

Class 1, attribute 1, mean = 63.32, std = 8.49
Class 1, attribute 2, mean = 95.53, std = 14.55
Class 1, attribute 3, mean = 108.14, std = 12.64
Class 1, attribute 4, mean = 88.50, std = 8.98
Class 1, attribute 5, mean = 63.03, std = 8.09
Class 1, attribute 6, mean = 95.20, std = 14.62
Class 1, attribute 7, mean = 107.89, std = 12.52
Class 1, attribute 8, mean = 88.48, std = 8.98
Class 1, attribute 9, mean = 62.73, std = 7.87
Class 1, attribute 10, mean = 94.58, std = 15.10
Class 1, attribute 11, mean = 107.47, std = 12.55
Class 1, attribute 12, mean = 88.25, std = 9.32
Class 1, attribute 13, mean = 62.98, std = 8.34
Class 1, attribute 14, mean = 95.30, std = 14.55
Class 1, attribute 15, mean = 108.07, std = 12.72
Class 1, attribute 16, mean = 88.52, std = 8.94
Class 1, attribute 17, mean = 62.83, std = 8.02
Class 1, attribute 18, mean = 95.29, std = 14.55
Class 1, attribute 19, mean = 108.12, std = 12.64
Class 1, attribute 20, mean = 88.60, std = 8.82
Class 1, attribute 21, mean = 62.63, std = 7.57

Class 1, attribute 22, mean = 94.88, std = 14.67
 Class 1, attribute 23, mean = 107.75, std = 12.64
 Class 1, attribute 24, mean = 88.34, std = 8.90
 Class 1, attribute 25, mean = 62.56, std = 8.07
 Class 1, attribute 26, mean = 94.52, std = 14.73
 Class 1, attribute 27, mean = 107.56, std = 12.55
 Class 1, attribute 28, mean = 88.23, std = 8.96
 Class 1, attribute 29, mean = 62.52, std = 7.82
 Class 1, attribute 30, mean = 94.73, std = 14.75
 Class 1, attribute 31, mean = 107.66, std = 12.66
 Class 1, attribute 32, mean = 88.34, std = 8.91
 Class 1, attribute 33, mean = 62.39, std = 7.56
 Class 1, attribute 34, mean = 94.66, std = 14.65
 Class 1, attribute 35, mean = 107.70, std = 12.55
 Class 1, attribute 36, mean = 88.39, std = 8.92
 Class 2, attribute 1, mean = 50.41, std = 9.77
 Class 2, attribute 2, mean = 43.04, std = 17.76
 Class 2, attribute 3, mean = 112.51, std = 14.19
 Class 2, attribute 4, mean = 115.33, std = 22.34
 Class 2, attribute 5, mean = 49.72, std = 8.79
 Class 2, attribute 6, mean = 41.88, std = 16.94
 Class 2, attribute 7, mean = 112.88, std = 13.76
 Class 2, attribute 8, mean = 116.13, std = 21.58
 Class 2, attribute 9, mean = 49.76, std = 9.31
 Class 2, attribute 10, mean = 42.28, std = 18.16
 Class 2, attribute 11, mean = 113.16, std = 13.99
 Class 2, attribute 12, mean = 116.07, std = 21.87
 Class 2, attribute 13, mean = 50.02, std = 9.64
 Class 2, attribute 14, mean = 41.63, std = 16.91
 Class 2, attribute 15, mean = 113.58, std = 12.70
 Class 2, attribute 16, mean = 117.62, std = 19.94
 Class 2, attribute 17, mean = 48.84, std = 7.57
 Class 2, attribute 18, mean = 39.91, std = 13.48
 Class 2, attribute 19, mean = 113.89, std = 12.64
 Class 2, attribute 20, mean = 118.31, std = 19.29
 Class 2, attribute 21, mean = 48.93, std = 8.03
 Class 2, attribute 22, mean = 40.32, std = 15.04
 Class 2, attribute 23, mean = 113.49, std = 13.55
 Class 2, attribute 24, mean = 117.43, std = 21.08
 Class 2, attribute 25, mean = 50.87, std = 10.80
 Class 2, attribute 26, mean = 43.52, std = 19.64
 Class 2, attribute 27, mean = 113.09, std = 13.64
 Class 2, attribute 28, mean = 116.25, std = 22.17
 Class 2, attribute 29, mean = 49.88, std = 9.20
 Class 2, attribute 30, mean = 41.47, std = 16.45
 Class 2, attribute 31, mean = 113.18, std = 14.00

Class 2, attribute 32, mean = 116.94, std = 22.03
 Class 2, attribute 33, mean = 49.48, std = 8.51
 Class 2, attribute 34, mean = 41.07, std = 15.52
 Class 2, attribute 35, mean = 112.54, std = 14.59
 Class 2, attribute 36, mean = 115.98, std = 23.17
 Class 3, attribute 1, mean = 86.94, std = 6.36
 Class 3, attribute 2, mean = 104.34, std = 9.20
 Class 3, attribute 3, mean = 109.72, std = 8.46
 Class 3, attribute 4, mean = 86.83, std = 6.62
 Class 3, attribute 5, mean = 86.97, std = 6.15
 Class 3, attribute 6, mean = 104.57, std = 8.96
 Class 3, attribute 7, mean = 109.83, std = 8.33
 Class 3, attribute 8, mean = 86.89, std = 6.63
 Class 3, attribute 9, mean = 86.43, std = 6.81
 Class 3, attribute 10, mean = 103.84, std = 10.17
 Class 3, attribute 11, mean = 109.41, std = 8.90
 Class 3, attribute 12, mean = 86.60, std = 7.75
 Class 3, attribute 13, mean = 87.42, std = 5.74
 Class 3, attribute 14, mean = 105.18, std = 8.22
 Class 3, attribute 15, mean = 110.61, std = 7.59
 Class 3, attribute 16, mean = 87.53, std = 6.03
 Class 3, attribute 17, mean = 87.48, std = 5.04
 Class 3, attribute 18, mean = 105.50, std = 6.87
 Class 3, attribute 19, mean = 110.60, std = 7.23
 Class 3, attribute 20, mean = 87.46, std = 6.05
 Class 3, attribute 21, mean = 86.86, std = 5.98
 Class 3, attribute 22, mean = 104.73, std = 8.26
 Class 3, attribute 23, mean = 109.83, std = 8.34
 Class 3, attribute 24, mean = 87.00, std = 7.34
 Class 3, attribute 25, mean = 86.87, std = 7.08
 Class 3, attribute 26, mean = 104.56, std = 10.48
 Class 3, attribute 27, mean = 110.45, std = 8.32
 Class 3, attribute 28, mean = 87.66, std = 7.17
 Class 3, attribute 29, mean = 86.87, std = 6.12
 Class 3, attribute 30, mean = 104.91, std = 8.47
 Class 3, attribute 31, mean = 110.00, std = 8.17
 Class 3, attribute 32, mean = 87.20, std = 6.96
 Class 3, attribute 33, mean = 86.22, std = 6.73
 Class 3, attribute 34, mean = 104.08, std = 8.87
 Class 3, attribute 35, mean = 109.23, std = 9.03
 Class 3, attribute 36, mean = 86.52, std = 7.88
 Class 4, attribute 1, mean = 77.06, std = 7.57
 Class 4, attribute 2, mean = 90.29, std = 11.87
 Class 4, attribute 3, mean = 96.61, std = 8.62
 Class 4, attribute 4, mean = 76.89, std = 7.97
 Class 4, attribute 5, mean = 76.60, std = 7.02

Class 4, attribute 6, mean = 89.64, std = 11.19
Class 4, attribute 7, mean = 95.77, std = 8.64
Class 4, attribute 8, mean = 75.69, std = 7.49
Class 4, attribute 9, mean = 75.68, std = 7.36
Class 4, attribute 10, mean = 87.82, std = 11.90
Class 4, attribute 11, mean = 94.64, std = 8.75
Class 4, attribute 12, mean = 75.29, std = 8.59
Class 4, attribute 13, mean = 77.28, std = 6.34
Class 4, attribute 14, mean = 90.79, std = 9.59
Class 4, attribute 15, mean = 96.07, std = 8.63
Class 4, attribute 16, mean = 75.76, std = 7.29
Class 4, attribute 17, mean = 77.41, std = 5.54
Class 4, attribute 18, mean = 90.94, std = 8.16
Class 4, attribute 19, mean = 95.61, std = 7.91
Class 4, attribute 20, mean = 75.35, std = 6.53
Class 4, attribute 21, mean = 76.74, std = 5.86
Class 4, attribute 22, mean = 89.59, std = 8.74
Class 4, attribute 23, mean = 94.81, std = 7.85
Class 4, attribute 24, mean = 74.85, std = 6.91
Class 4, attribute 25, mean = 76.50, std = 6.86
Class 4, attribute 26, mean = 90.33, std = 10.25
Class 4, attribute 27, mean = 95.71, std = 9.57
Class 4, attribute 28, mean = 75.57, std = 8.40
Class 4, attribute 29, mean = 76.54, std = 6.76
Class 4, attribute 30, mean = 89.81, std = 10.13
Class 4, attribute 31, mean = 95.75, std = 8.87
Class 4, attribute 32, mean = 75.70, std = 8.31
Class 4, attribute 33, mean = 76.13, std = 6.85
Class 4, attribute 34, mean = 88.73, std = 10.79
Class 4, attribute 35, mean = 95.51, std = 8.27
Class 4, attribute 36, mean = 75.83, std = 8.74
Class 5, attribute 1, mean = 60.74, std = 7.84
Class 5, attribute 2, mean = 64.33, std = 13.99
Class 5, attribute 3, mean = 83.49, std = 13.19
Class 5, attribute 4, mean = 69.98, std = 14.13
Class 5, attribute 5, mean = 60.00, std = 7.00
Class 5, attribute 6, mean = 62.99, std = 12.70
Class 5, attribute 7, mean = 83.16, std = 12.90
Class 5, attribute 8, mean = 69.98, std = 13.94
Class 5, attribute 9, mean = 60.20, std = 7.33
Class 5, attribute 10, mean = 63.20, std = 12.91
Class 5, attribute 11, mean = 83.71, std = 13.26
Class 5, attribute 12, mean = 70.78, std = 14.09
Class 5, attribute 13, mean = 60.39, std = 7.36
Class 5, attribute 14, mean = 63.74, std = 13.28
Class 5, attribute 15, mean = 83.89, std = 13.00

Class 5, attribute 16, mean = 70.28, std = 13.65
 Class 5, attribute 17, mean = 59.59, std = 6.09
 Class 5, attribute 18, mean = 62.27, std = 11.64
 Class 5, attribute 19, mean = 83.02, std = 12.57
 Class 5, attribute 20, mean = 69.95, std = 13.13
 Class 5, attribute 21, mean = 59.76, std = 6.58
 Class 5, attribute 22, mean = 62.54, std = 12.61
 Class 5, attribute 23, mean = 83.32, std = 12.90
 Class 5, attribute 24, mean = 70.76, std = 13.35
 Class 5, attribute 25, mean = 60.95, std = 8.27
 Class 5, attribute 26, mean = 64.65, std = 14.79
 Class 5, attribute 27, mean = 84.75, std = 13.68
 Class 5, attribute 28, mean = 71.50, std = 14.77
 Class 5, attribute 29, mean = 60.26, std = 7.71
 Class 5, attribute 30, mean = 63.60, std = 14.05
 Class 5, attribute 31, mean = 84.11, std = 13.60
 Class 5, attribute 32, mean = 71.04, std = 14.22
 Class 5, attribute 33, mean = 60.21, std = 8.14
 Class 5, attribute 34, mean = 63.58, std = 15.01
 Class 5, attribute 35, mean = 84.75, std = 13.87
 Class 5, attribute 36, mean = 71.76, std = 14.38
 Class 7, attribute 1, mean = 69.38, std = 6.54
 Class 7, attribute 2, mean = 77.93, std = 9.85
 Class 7, attribute 3, mean = 82.76, std = 10.20
 Class 7, attribute 4, mean = 65.29, std = 9.59
 Class 7, attribute 5, mean = 69.36, std = 6.12
 Class 7, attribute 6, mean = 77.95, std = 9.25
 Class 7, attribute 7, mean = 82.61, std = 9.88
 Class 7, attribute 8, mean = 65.05, std = 8.78
 Class 7, attribute 9, mean = 69.38, std = 6.30
 Class 7, attribute 10, mean = 78.13, std = 9.63
 Class 7, attribute 11, mean = 82.64, std = 10.21
 Class 7, attribute 12, mean = 65.10, std = 8.75
 Class 7, attribute 13, mean = 69.11, std = 5.74
 Class 7, attribute 14, mean = 77.58, std = 8.28
 Class 7, attribute 15, mean = 81.93, std = 9.14
 Class 7, attribute 16, mean = 64.30, std = 7.65
 Class 7, attribute 17, mean = 69.01, std = 5.38
 Class 7, attribute 18, mean = 77.42, std = 7.69
 Class 7, attribute 19, mean = 81.59, std = 8.74
 Class 7, attribute 20, mean = 64.13, std = 7.36
 Class 7, attribute 21, mean = 69.05, std = 5.78
 Class 7, attribute 22, mean = 77.56, std = 8.61
 Class 7, attribute 23, mean = 82.04, std = 9.48
 Class 7, attribute 24, mean = 64.46, std = 8.10
 Class 7, attribute 25, mean = 69.20, std = 6.08

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Class 7, attribute 26, mean = 77.61, std = 9.11
Class 7, attribute 27, mean = 82.21, std = 9.58
Class 7, attribute 28, mean = 64.73, std = 8.14
Class 7, attribute 29, mean = 69.06, std = 5.97
Class 7, attribute 30, mean = 77.68, std = 8.86
Class 7, attribute 31, mean = 82.16, std = 9.74
Class 7, attribute 32, mean = 64.73, std = 8.17
Class 7, attribute 33, mean = 69.15, std = 6.18
Class 7, attribute 34, mean = 77.94, std = 9.35
Class 7, attribute 35, mean = 82.40, std = 10.18
Class 7, attribute 36, mean = 65.13, std = 8.65
classification accuracy=0.1265
```