Q.10

Document	Size	Color	Shape	Category
d1	small	red	circle	positive
d2	large	red	circle	positive
d3	small	red	triangle	negative
d4	large	blue	circle	negative
d5	medium	red	circle	???????

1. **Find Following Values**
   P (Medium | Positive)
   P (Red | Positive)
   P (Circle | Positive)
   P (Medium | Negative)
   P (Red| Negative)
   P (Circle | Negative)
   P(Positive)
   P(Negative)

   P (Medium | Positive) = (0+1)/ (6+7) = 1/13
   P (Red | Positive) = (2+1)/ (6+7) = 3/13
   P (Circle| Positive) = (2+1)/ (6+7) = 3/13

   P (Medium | Negative) = (0+1)/ (6+7) = 1/13
   P (Red | Negative) = (1+1)/ (6+7) = 2/13
   P (Circle| Negative) = (1+1)/ (6+7) = 2/13

   P(Positive) = 2/4 = 1/2
   P(Negative) = 2/4 = 1/2

2. **P(Positive|d5)** = P(Positive) * P (d5| Positive) / P(d5)
   = P(Positive) * P (Medium ∩ Red ∩ Circle |Positive) / P(d5)
   = (P(Positive) * (P (Medium | Positive) * P (Red | Positive) * P (Circle | Positive))) / P(d5)
   ∝ (P(Positive) * (P (Medium | Positive) * P (Red | Positive) * P (Circle |Positive)))
   = (1/2) * (1/13) * (3/13) * (3*13)
   = 0.0020

3. **P(Negative|d5)** = P(Negative) * P (d5| Negative) / P(d5)
   = P(Negative) * P (Medium ∩ Red ∩ Circle | Negative) / P(d5)
   = (P(Negative) * (P (Medium | Negative) * P (Red | Negative) * P (Circle | Negative))) / P(d5)
   ∝ (P(Negative) * (P (Medium | Negative) * P (Red | Negative) * P (Circle | Negative)))
   = (1/2) * (1/13) * (2/13) * (2*13)
   = 0.0009

So, D5 should belong to Positive Category.

Q.12

	Doc	Words	Author
Training	1	W1 W2 W3 W4 W5	C (Christopher Marlowe)
	2	W1 W1 W4 W3	C (Christopher Marlowe)
	3	W1 W2 W5	C (Christopher Marlowe)
	4	W5 W6 W1 W2 W3	W (William Stanley)
	5	W4 W5 W6	W (William Stanley)
	6	W4 W6 W3	F (Francis Bacon)
	7	W2 W2 W4 W3 W5 W5	F (Francis Bacon)
Test	8 (Hamlet)	W1 W4 W6 W5 W3	?

1. **Find Following Values**

P (W1 | C) **P (W4 | C)**
P (W6 | C) **P (W5 | C)**
P (W3 | C)

P (W1 | W) **P (W4 | W)**
P (W6 | W) **P (W5 | W)**
P (W3 | W)

P (W1 | F) **P (W4 | F)**
P (W6 | F) **P (W5 | F)**
P (W3 | F)

P(C) **P(W)**
P(F)

P (W1 | C) = (4+1)/ (12+ 6) = 5/ 18
P (W4 | C) = (2+1)/ (12+ 6) = 3/ 18 = 1/6
P (W6 | C) = (0+1)/ (12+ 6) = 1/ 18
P (W5 | C) = (2+1)/ (12+ 6) = 3/ 18 = 1/6
P (W3 | C) = (2+1)/ (12+ 6) = 3/ 18 = 1/6

P (W1 | W) = (1+1)/ (8+ 6) = 2/ 14 = 1/7
P (W4 | W) = (1+1)/ (8+ 6) = 2/ 14 = 1/7
P (W6 | W) = (2+1)/ (8+ 6) = 3/ 14
P (W5 | W) = (2+1)/ (8+ 6) = 3/ 14

P (W3 | W) = (1+1)/ (8+ 6) = 2/ 14 = 1/7

P (W1 | F) = (0+1)/ (9+ 6) = 1/ 15
P (W4 | F) = (2+1)/ (9+ 6) = 3/ 15 = 1/5
P (W6 | F) = (1+1)/ (9+ 6) = 2/ 15
P (W5 | F) = (2+1)/ (9+ 6) = 3/ 15 = 1/5
P (W3 | F) = (2+1)/ (9+ 6) = 3/ 15 = 1/5

P(C) = 3/7
P(W) = 2/7
P(F) = 2/7

2. **P(C|d8)** = P(C) * P (d8| C) / P(d8)
   = P(C) *P (W1 ∩ W4∩ W6 ∩ W5∩ W3 |C) / P(d8)
   = (P(C) * (P (W1 | C) * P (W4| C) * P (W6| C) * P (W5| C) * P (W3| C))) / P(d8)
   ∝ = (P(C) * (P (W1 | C) * P (W4| C) * P (W6| C) * P (W5| C) * P (W3| C)))
   = (3/7) * (5/18) * (1/6) * (1/18) *(1/6) *(1/6)
   = 0.000030

3. **P(W|d8)** = P(W) * P (d8| W) / P(d8)
   = P(W) *P (W1 ∩ W4∩ W6 ∩ W5∩ W3 |W) / P(d8)
   = (P(W) * (P (W1 | W) * P (W4| W) * P (W6| W) * P (W5| W) * P (W3| W))) / P(d8)
   ∝ = (P(W) * (P (W1 | W) * P (W4| W) * P (W6| W) * P (W5| W) * P (W3| W)))
   = (2/7) * (1/7) * (1/7) * (3/14) *(3/14) *(1/7)
   = 0.000038

4. **P(F|d8)** = P(W) * P (d8| F) / P(d8)
   = P(F) *P (W1 ∩ W4∩ W6 ∩ W5∩ W3 |F) / P(d8)
   = (P(F) * (P (W1 | F) * P (W4| F) * P (W6| F) * P (W5| F) * P (W3| F))) / P(d8)
   ∝ = (P(F) * (P (W1 | F) * P (W4| F) * P (W6| F) * P (W5| F) * P (W3| F)))
   = (2/7) * (1/15) * (1/5) * (2/15) *(1/5) *(1/5)
   = 0.000020

So, D8 (Hamlet) Belongs to W (William Stanley)