Problem set 4
Probabilistic classifiers

Exercise 1

1. For Example 2 in "Probabilistic classifiers" video, compute the maximum likelihood estimation for the parameter β when the observed data contains h heads and t tails.

   Hint*: find β that maximizes the log likelihood function $h \log \beta + t \log(1-\beta)$

2. Interpret the resulting estimate.

Excercise 2

Feature x can take one of the three values: cat, dog, rabbit. Let $n(\text{cat}, c) = 9$, $n(\text{dog}, c) = 0$, and $n(\text{rabbit}, c) = 1$, where $n(a, c)$ denotes the number of training objects in class c with $x = a$.

1. Estimate the probabilities $P(x = \text{cat} \mid c)$, $P(x = \text{dog} \mid c)$, $P(x = \text{rabbit} \mid c)$.

2. Smooth the obtained probabilities using Laplace smoothing.

Excercise 3

Imagine that you are given the following set of training examples. Each feature can take on one of three nominal values: a, b, or c.

F_1	F_2	F_3	Class Label
a	c	b	+
c	a	c	+
a	a	c	-
b	c	a	-
c	c	b	-

How would a Naive Bayes system classify the following test example? $F_1 = a, F_2 = c, F_3 = b$