	$X=1$	$X=2$	$X=3$
$Y=1$	0.1	0.05	0.2
$Y=2$	0.05	0.25	0.35

1. Derive the following for random variables X and Y
   a. $\Pr(X=1) = 0.1 + 0.05 = 0.15$
   b. $\Pr(X=2 \cap Y=1) = 0.25$
   c. $\Pr(X=3 \mid Y=2) = \frac{P(X \cap Y)}{\Pr(Y)} = \frac{0.35}{0.05+0.25+0.35} = 0.318$

2. Given 2 die D_1 and D_2 with $\Omega = \{1,2,3,4,5,6\}$, find the following
   a. $\Pr(D_1$ has a larger value than $D_2)$

	D_1 Values
$D_2=1$	$\{2,3,4,5,6\}$
$D_2=2$	$\{3,4,5,6\}$
$D_2=3$	$\{4,5,6\}$
$D_2=4$	$\{5,6\}$
$D_2=5$	$\{6\}$
$D_2=6$	$\{\}$

Since there are 6^2 possible combination of outcomes, and we see from the table that 15 D_1values that are greater than D_2 the answer is $\frac{15}{36} = \frac{5}{12}$

   b. Expected value of the sum of $D_1$and D_2

$$E[X] = \sum_{\omega \in \Omega} \omega * \Pr[X = \omega]$$

Sums	$D_1=1$	$D_1=2$	$D_1=3$	$D_1=4$	$D_1=5$	$D_1=6$
$D_2=1$	2	3	4	5	6	7
$D_2=2$	3	4	5	6	7	8
$D_2=3$	4	5	6	7	8	9
$D_2=4$	5	6	7	8	9	10
$D_2=5$	6	7	8	9	10	11
$D_2=6$	7	8	9	10	11	12

Value	2	3	4	5	6	7	8	9	10	11	12
P[Value]	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

$$2\left(\frac{1}{36}\right) + 3\left(\frac{2}{36}\right) + 4\left(\frac{3}{36}\right) + 5\left(\frac{4}{36}\right) + 6\left(\frac{5}{36}\right) + 7\left(\frac{6}{36}\right) + 8\left(\frac{5}{36}\right) + 9\left(\frac{4}{36}\right) + 10\left(\frac{3}{36}\right) + 11\left(\frac{2}{36}\right) + 12\left(\frac{1}{36}\right)$$
$$= \frac{2+6+12+20+30+42+40+36+30+22+12}{36} = \frac{252}{36} = 7$$

3. For $f(X=x) = \begin{cases} \frac{1}{2} \; if \; x \in [0,2] \\ 0 \; if \; x \notin [0,2] \end{cases}$ what Is $\Pr\big(f(X=1)\big)$?

The probability that a continuous random variable equal any number is exactly 0

4. For $D = \{-1,7,4\}$, and M from $\Omega = \{1,3,5\}$. m pulled from $f(x) = \frac{1}{6}\exp\left(-\frac{|m-x|}{3}\right)$, and $\Pr(M = 1) = 0.4, \Pr(M = 3) = 0.3$, and $\Pr(M = 5) = 0.3$, find which model is most likely
Given that $\ln(\Pr(D \mid M) = \sum_{x \in \Omega} \frac{-|m-x|}{3}$
$M = 1$

$$-\frac{|0.4+1|}{3} - \frac{|0.4-7|}{3} - \frac{|0.4-4|}{3} = -\frac{1.4+6.6+3.6}{3} = \frac{-8.4}{3}$$

$M = 3$

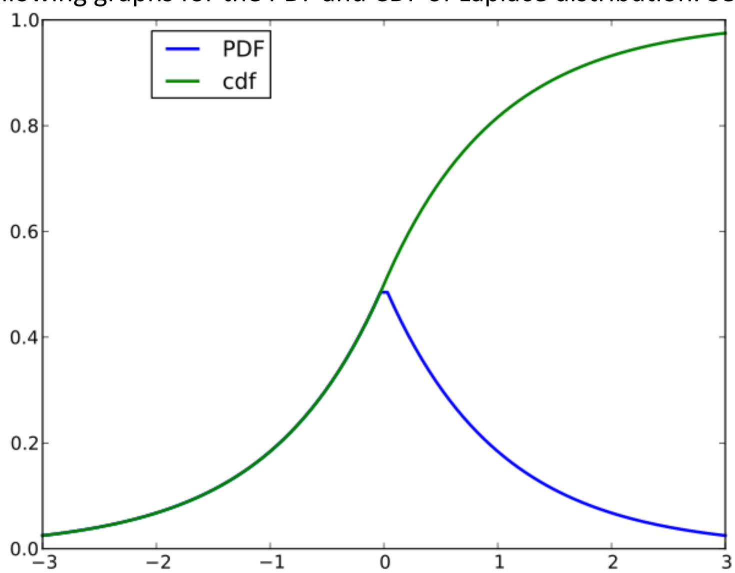
$$-\frac{|0.3+1|}{3} - \frac{|0.3-7|}{3} - \frac{|0.3-4|}{3} = -\frac{1.3+6.7+3.7}{3} = -\frac{11.7}{3}$$

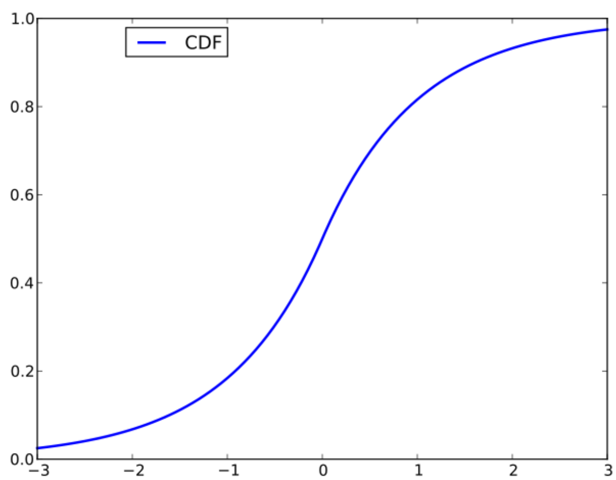
$M = 5$

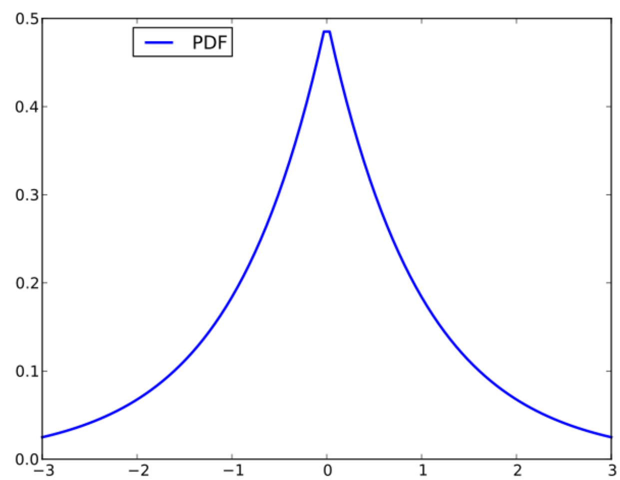
$$-\frac{|0.3+1|}{3} - \frac{|0.3-7|}{3} - \frac{|0.3-4|}{3} = -\frac{1.3+6.7+3.7}{3} = -\frac{11.7}{3}$$

$M = 1$ is the most likely model

5. Generated following graphs for the PDF and CDF of Laplace distribution. See code below







```
import matplotlib as mpl
mpl.use('svg')
import matplotlib.pyplot as plt
import matplotlib.mlab as mlab
from scipy.stats import laplace as l
import numpy as np
import math

x = np.linspace(-3,3,100)

plt.plot(x, l.pdf(x), linewidth=2.0, label='PDF')
plt.plot(x, l.cdf(x), linewidth=2.0, label='CDF')

plt.legend(bbox_to_anchor=(.35,1))
plt.savefig('cdf.svg', bbox_inches='tight')
```