Problem 1:

a) no. of features $P = 1$

$X \rightarrow$ uniformly distributed on $[0, 1]$

10% range is used when predicting a test observation

I. i.e., for $X = 0.6$ we look at $[0.55, 0.65]$

$X = 0.5$ we consider $[0.45, 0.55]$

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but for $X = 0.4$ ($X < 0.5$ Scenario)

II. we take only $[0, 0.9]$

III. Similarly for ($X > 0.95$) $X = 0.99$

we look at only $[0.94, 1]$

So on an average we consider, the fraction of available observations we consider for prediction is <u>less than 10%</u>

Exact value can be calcutate using area method.

for $[0.05, 0.95] \Rightarrow 10\%$

for $[0, 0.05] \Rightarrow (100x+5)\%$

$[0.95, 1] \Rightarrow (105-100x)\%$

So integral sum of these values give total area (fraction we are interested in)

$$= \int_{0.5}^{0.95} 10\,dx + \int_{0.0}^{0.05} (100x+5)\,dx + \int_{.95}^{1} (105-100x)\,dx$$

$$= 9 + 0.375 + 0.375$$

$$= 9.750$$

$$= \boxed{9.75\%}$$

We expect to look at 9.75% observations on average.

(b) with $p = 2$.

(x_1, x_2) uniformly distributed on $[0,1] \times [0,1]$

$\Rightarrow$ Examples.

(I) $x_1 = 0.6$; $x_2 = 0.35$.

observation range would be.

$x_1 \to [0.55, 0.65]$

$x_2 \to [0.3, 0.4]$

(II) $x_1 = 0.04$; $x_2 = 0.5$

$x_1 \to [0, 0.09]$ $x_2 \Rightarrow [0.45, 0.5]$.

it is similar to previous case.

in case $P = 2$

the fraction would be $= (9.75) \times (9.75)$

$= \cancel{.95} = \boxed{0.95\%}$

(c) $P = 100$

the fraction aviable observation for making prediction would be $(0.95)^{100} \simeq 0\%$

(d) as we insremen P (number of featur) we left with fewer fraction of observation for prediction

as $P \rightarrow \infty$ this would be Zero.

(e) 10% training observations are und for prediction

$P=1 \rightarrow$ line $\Rightarrow$ length $= \left(\frac{1}{10}\right)$

$P=2 \rightarrow$ Square $=$ length $= \left(\frac{1}{10}\right)^{2}$

$P=100 \rightarrow$ length $= \left(\frac{1}{100}\right)^{100}$