CS 177 HW 3

1) a. $4.8 = \boxed{32 \text{ minutes}}$

b. $\sqrt{Var[x]} = \sigma$

$\boxed{\sigma = \sqrt{\frac{1}{\theta^2}} = \frac{1}{\theta} = E[x] = 8}$

c. $F_x(10) = \int_{-\infty}^{10} .125 e^{-.125x} dx$

$= \int_{-\infty}^{10} \frac{e^{-\frac{x}{8}}}{8}$

$= -e^{-\frac{x}{8}} \Big|_0^{10}$

$= 1 - e^{-\frac{5}{4}}$

$= .7135$

$.7135 \times .7135 \times .7135 \times .7135 = \boxed{.2592}$

d. $\boxed{E[x] = 8 \text{ minutes}}$
$\boxed{\sigma_x = 8 \text{ minutes}}$

3) a. $Y = 0$ (correctly manufactured) $\quad P_Y(0) = .50$

$Y = 1$ (malfunctions) $\quad P_Y(1) = .50$

$E[x|Y=0] = 1 = \frac{1}{\theta_0}$ $\quad E[x|Y=1] = 50 = \frac{1}{\theta_1}$

$\theta_0 = 1$ $\quad \theta_1 = .02$

$P(Y=1|X=c) = P(Y=0|X=c)$

$.8e^{-c} = .8e^{-50c}$

$\boxed{c = .02}$

b. $P(Y=0) = .99 \qquad P(Y=1) = .01$

$$P(Y=1 \mid X=c) = P(Y=0 \mid X=c)$$
$$.01e^{-c} = .99e^{-50c}$$
$$\ln(.01e^{-c}) = \ln(.99e^{-50c})$$
$$\ln(.01) + \ln(e^{-c}) = \ln(.99) + \ln(e^{-50c})$$
$$-c + 50c = \ln(.99) - \ln(.01)$$
$$49c = \ln\left(\frac{.99}{.01}\right)$$
$$\boxed{c = .09}$$

c. $\lambda_{10} = 500\,\lambda_{01}$

$P_Y(0) = .99$

$$\frac{P_{X|Y}(x|1)}{P_{X|Y}(x|0)} \geq \left(\frac{.99}{1-.99}\right)\left(\frac{\lambda_{01}}{500\lambda_{01}}\right)$$

$$\frac{P_{X|Y}(x|1)}{P_{X|Y}(x|0)} \geq (99)\left(\frac{1}{500}\right)$$

$$\frac{P_{X|Y}(x|1)}{P_{X|Y}(x|0)} \geq .198$$

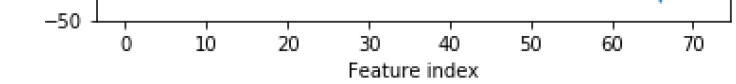
```
print("---HW3 QUESTION 2---")
print("-------PART A-------")

runtimeMean = 13
runtimeSTD = 2.0

print("1 - CDF(18) =", 1 - scipy.stats.norm.cdf(18, 13, 2))

print()
print("-------PART B-------")
print("CDF(16) - CDF(10) =", scipy.stats.norm.cdf(16, 13, 2) - scipy.stats.norm.cdf(10, 13, 2))

print()
print("-------PART C-------")
print("Z value at 1% = .233")
print(".233 = (13 - mean) / 2.0")
print("mean = 8.3473")
```




```
---HW3 QUESTION 2---
-------PART A-------
1 - CDF(18) = 0.006209665325776159

-------PART B-------
CDF(16) - CDF(10) = 0.8663855974622838

-------PART C-------
Z value at 1% = .233
.233 = (13 - mean) / 2.0
mean = 8.3473


---HW3 QUESTION 3---
-------PART A-------
```