A continuous stochastic process is given by:

$$X(t) = w + 4$$

Where w is Gaussian distributed after $w \sim N(5,1)$.

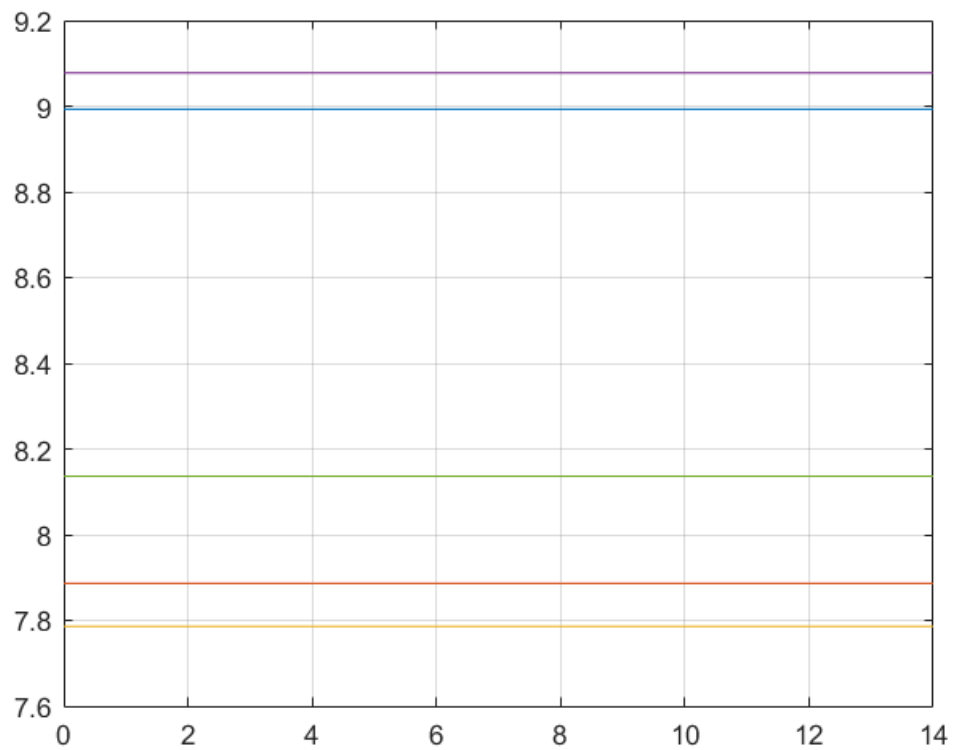1) Sketch five realizations of the process $X(t)$ between $t \in [0; 7].$ Gaussian random number generator, it can e.g. be the build in gen matlab, *randn()*. State how the five realizations are generated.

```matlab
%(randn(1,5)*sigma)+mu
sigma = 1;
mu = 5;
w=(randn(1,5)*sigma)+mu;%%Create 5 random values with randn
%offset with 5 cause of the mu value, the sigma value is multiplied to every random generated r
%the only reason we can use randn is because the gaussian distribution is a normaldistributtion

t=0:7;%%t is between 0 and 7. Important to know that we can't with 100% certainty say that 0-7

x5=w(5)+4;%One possible realization of the process of X(t)
x4=w(4)+4;
x3=w(3)+4;
x2=w(2)+4;
x1=w(1)+4;

plot(t,ones(1,length(t))*x5)
grid
hold on
plot(t,ones(1,length(t))*x4)
plot(t,ones(1,length(t))*x3)
plot(t,ones(1,length(t))*x2)
plot(t,ones(1,length(t))*x1)
```

If the code is run multiple times it's shown that the realizations change.

This is due to an infinite amount of realizations within an interval.

2) Find the ensemble mean value and the ensemble variance for the process $X(t)$.

$$X(t)=w+4 \qquad \mu=5$$
$$\sigma^2=1$$
$$w\sim N(5,1)=w\sim N(\mu,\sigma^2)$$

Ensamble mean for the proccess is calculated like this
The mean of a constant is the constant
$$E\left[X(t)\right]=E\left[w\right]+E\left[4\right]$$

$$E\left[X(t)\right]=5+4=9$$

A constant does not vary in value, therefor it is 0
$$var\left[X(t)\right]=var\left[w\right]+var\left[4\right]$$

$$var\left[X(t)\right]=1+0=1$$

3) Select one of the five realizations, and decide the mean value and variance for that realization.

```
meanOfRealization = mean(x3)+ mean(4)
```

meanOfRealization = 11.7859

```
varOfRealization = var(x3)+var(4)
```

varOfRealization = 0

The variance of one realization doesn't say much because it will always be 0.

4) State whether the process $X(t)$ is WSS (wide sense stationary), a whether it is ergodic. State the reason behind your answers.

The ensamble variance and the ensamble mean does not have an aspect of time in the formula, etc. w+4*t or w +4/t. That means that the process X(t) is

independent of time and **is therefore Wide State Stationary**. In addition if you double the time interval the ensamble variance and ensamble mean stays the same.

The time average is not equal for all the realizations and is therefor not ergodic.