Exam time: 2 hours

Instructions:
1. For writing your answers use both sides of the paper in the answer booklet.

2. Additional sheets taken, if any, should be properly attached to the main answer booklet.

3. **(2 points) Please write your name on every page of this booklet and every additional sheet taken.**
4. Maximum time is 2 hours

Score

Q.No.	**Alloted Score**	**Score**
1.	(15 points)	
2.	(15 points)	
3.	(10 points)	
4.	(10 points)	
Total	50	

Number of Extra sheets attached to the answer script: _____

1. (15 points) In one or two sentences, describe each line in R-code below:

a)

```
> U = runif(1)
> X = tan(pi*(U-0.5))
```

b)

```
> K = 1;
> p = 0.5;
> while(runif(1) > p)
+ K = K + 1;
> K
```

Find the distribution (i.e. Range and p.m.f. or p.d.f.) of output variable X and K.

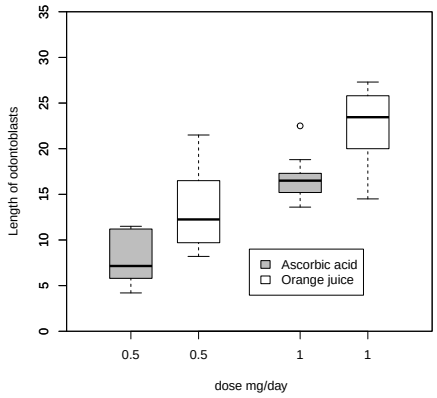
2. (15 points) Let $X_1, X_2, X_3, \ldots, X_n$ of i.i.d. radioactive measurements following Exponential(θ). Find the maximum likelihood estimate for θ.

3 (10 points) The ToothGrowth dataset in R studies the *the Effect of Vitamin C on Tooth Growth in Guinea Pigs*. We are given the following.

Documentation from R

Description The response is the length of odontoblasts (cells responsible for tooth growth) in 60 guinea pigs. Each animal received one of three dose levels of vitamin C (0.5, 1, and 2 mg/day) by one of two delivery methods, orange juice or ascorbic acid.
Format A data frame with 60 observations on 3 variables.
[,1] len numeric Tooth length
[,2] supp factor Supplement type (ascorbic acid or orange Juice).
[,3] dose numeric Dose in milligrams/day

Plot



(a) (2 points) Describe the data (in 1-2 sentences) in each box plot.

(b) (2 points) Which data has the largest inter-quartile range ?

(c) (2 points) Are there any outliers in any data ?

(d) (4 points) From the plot(s) can you infer how the methods performed in relation to Tooth Growth ? Did one method perform better thatn the other ?

4. (10 points) Consider, $x = (x_1, \ldots, x_{10})$, a random sample from a Normal population with mean μ and variance 4. Using the appropriate output of the R-below find (with justification) a 95%-confidence interval for μ.

```
> mean(x)

[1] 174.7

> sd(x)

[1] 1.946507

> var(x)

[1] 3.788889
```

```
> pnorm(1.96)

[1] 0.9750021

> qnorm(0.95)

[1] 1.644854

> rnorm(1,0.95)

[1] 0.7439919
```

```
> sqrt(10)

[1] 3.162278

> 10^2

[1] 100

> 1/10

[1] 0.1
```