ASSIGNMENT 4

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SUBJECT: MAT1011 L4
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SLOT : L4

Q1) If 20% of bolts produced by a machine are found by defective. Determine the probability that out of four bolts chosen at random

(a) one

(b) zero

(c) at least two

(d) at most two

are defective? Find the mean and variance of the distribution.

```
dbinom(1,size=4,prob=0.2)
[1] 0.4096
> dbinom(0,size=4,prob=0.2)
[1] 0.4096
> pbinom(2,size=4,prob=0.2,lower.tail=TRUE)
[1] 0.9728
> pbinom(2,size=4,prob=0.2,lower.tail=FALSE)
[1] 0.0272
```

Q2: Suppose there are 12 multiple choice questions in an English class quiz. Each question has five possible answers, and only one of them is correct. Find the probability of having four or less correct answers if a student attempts to answer every question at random. Find mean and variance of the random variable. (Ans: 92.7%). Find the mean and variance of the distribution.

```
> pbinom(4,size=12,prob=0.2,lower.tail = 4)
[1] 0.9274445
> pb=c(dbinom(1:12,size=12,prob=0.2))
[1] 0.9312805
> pb=c(dbinom(0:12,size=12,prob=0.2))
> print(pb)
 [1] 6.871948e-02 2.061584e-01 2.834678e-01 2.362232e-01
 [5] 1.328756e-01 5.315022e-02 1.550215e-02 3.321889e-03
 [9] 5.190451e-04 5.767168e-05 4.325376e-06 1.966080e-07
```

```
[13] 4.096000e-09
> sum(pb)
[1] 1
> mean(pb)
[1] 0.07692308
> var(pb)
[1] 0.01059904
> mean(c(1:12))
[1] 6.5
> var(c(1:12))
[1] 13
```

Q3. A biologist estimates that the chance of germination for a type of bean seed is 0.7. A student was given six seeds. Let X be the number of seeds germinated from six seeds. Assuming that the germination of seeds are independent, why the distribution is binomial(write a sentence). What is the value of n and p? what are the probabilities that he gets

a) all seeds germination

b) just one seeds not generated, and

c) at most four seeds germinated?

Find the mean and variance of the distribution?

```
> pb=dbinom(6,size=6,prob=0.7)
> print(pb)
[1] 0.117649
> dbinom(5,size=6,prob=0.7)
[1] 0.302526
> pbinom(4,size=6,prob=0.7,lower.tail=FALSE)
[1] 0.420175
> pb=c(dbinom(0:6,size=6,prob=0.7))
> sum(pb)
[1] 1
> mean(pb)
[1] 0.1428571
> var(pb)
[1] 0.01758753
```

Q4) A pharmaceutical firm has discovered a new diagnostic test that has 90% chance to indicate a positive result for a patient who are infected by a certain disease. If it is tried on five infected patients, find the probability that four will be detected? Find the mean and variance of the distribution.

```
> dbinom(4,size=5,prob=0.9)
[1] 0.32805
> dbinom(0:5,size=5,prob=0.9)
```

```
[1] 0.00001 0.00045 0.00810 0.07290 0.32805 0.59049
> pb=dbinom(0:5,size=5,prob=0.9)
> var(pb)
[1] 0.05900176
> mean(pb)
[1] 0.1666667
```

Q5) The proportion of students wearing spectacles is 40%. Let X be the number of students wearing spectacles in a random sample of 10 students. Use R to find P(X<=2),P(2<=X<5),P(X>2),P(X=3).

```
> pb2=sum(c(dbinom(0:2,size=10,prob=0.4)))
> print(pb2)
[1] 0.1672898
> pb5=sum(c(dbinom(5:10,size=10,prob=0.4)))
> xmorethan2lessthan5=1-(pb2+pb5)
> print(xmorethan2lessthan5)
[1] 0.4658135
> dbinom(3,size=10,prob=0.4)
[1] 0.2149908
```

Q6) Two rival soft drinks C and P taste the same. In a blindfold test, 12 people are asked (independently) to state their preference for one or the other.

a) What is the probability that the majority prefer P?

b) How many people out of 12 people would prefer P-->6

```
> pb=sum(c(dbinom(7:12,size=12,prob=0.5)))
> print(pb)
[1] 0.387207
```