PS
Experiment 5

1.

A random variable X has the following probability distribution

X=x :	0	1	2
P(X=x):	1/3	1/3	1/3,

Find the moment generating function, first four raw moments and the first four central moment.

CODE:

```
# Q 1
x=c(0,1,2)
p=c(1/3,1/3,1/3)
mr0=1
mr1=sum(x*p)
mr2=sum(x*x*p)
mr3=sum(x*x*x*p)
mr4=sum(x*x*x*x*p)
rawm=c(mr0,mr1,mr2,mr3,mr4)
rawm
raw2central(rawm)
```

OUTPUT:

```
# Q 1
x=c(0,1,2)
p=c(1/3,1/3,1/3)
mr0=1
mr1=sum(x*p)
mr2=sum(x*x*p)
mr3=sum(x*x*x*p)
mr4=sum(x*x*x*x*p)
rawm=c(mr0,mr1,mr2,mr3,mr4)
rawm
1] 1.000000 1.000000 1.666667 3.000000 5.666667
raw2central(rawm)
1] 1.0000000 0.0000000 0.6666667 0.0000000 0.6666667
```

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E&PS

1) $x = 0 \quad 1 \quad 2$

$P(x) \quad 1/3 \quad 1/3 \quad 1/3$

mgf about origin $M_x(t) = E[e^{tx}]$

$$= \sum_{i=1}^{\infty} P(x_i) e^{tx_i}$$

$$= \frac{1}{3}[e^0 + e^t + e^{2t}]$$

First 4 moments about origin

$\mu_{r_0} = 1$

$\mu_{r_1} = E[x] = 1/3 + 2/3 = 1$

$\mu_{r_2} = E[x^2] = 5/3$

$\mu_{r_3} = 9/3 = 3 \qquad \mu_{r_4} = 17/3$

First 4 central moments

$\mu_{c_0} = 1 \quad \mu_{c_1} = 0$

$\mu_{c_2} = \mu_{r_2} - (\mu_{r_1})^2 = \frac{5}{3} - 1 = \frac{2}{3}$

$\mu_{c_3} = \mu_{r_3} - 3\mu_{r_1}\mu_{r_2} + 2\mu_{r_1} = 3 - 3(1)(\frac{5}{3}) + 2 = 0$

$\mu_{c_4} = \mu_{r_4} - 4\mu_{r_1}\mu_{r_3} + 6\mu_{r_1}\mu_{r_2} - 3\mu_{r_1} = \frac{17}{3} - 4(1)(3) - 3(1)^4 + 6(\frac{5}{3})$

$\mu_{c_4} = \frac{2}{3}$

2.

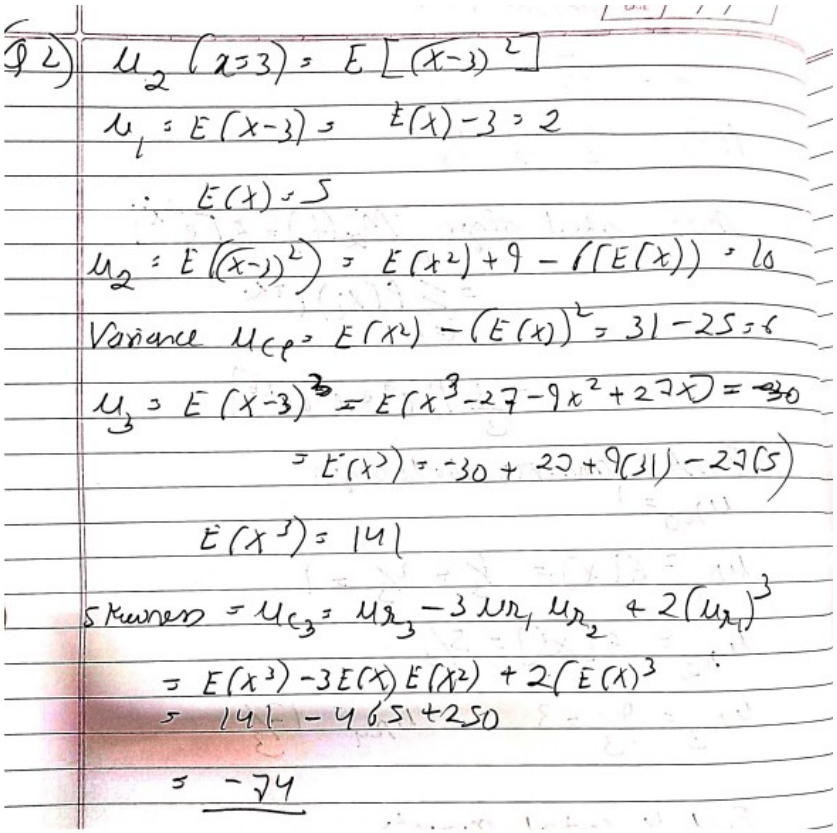
The first three moments of the distribution about the value 3 of the random variable are 2, 10, -30 respectively. Find mean variance and skewness.
Write a R program for above problem.

CODE:

```
# Q 2
m0=1
m1=2
m2=10
m3=-30
a=3
v=raw2central(c(m0,m1,m2,m3))
mean=m1+a
cat("Mean = ",mean)
cat("variance = ",v[3])
cat("Skewness = ",v[4])
```

OUTPUT:

```
> # Q 2
> m0=1
> m1=2
> m2=10
> m3=-30
> a=3
> v=raw2central(c(m0,m1,m2,m3))
> mean=m1+a
> cat("Mean = ",mean)
Mean =  5> cat("variance = ",v[3])
variance =  6> cat("Skewness = ",v[4])
Skewness =  -74
```



3.

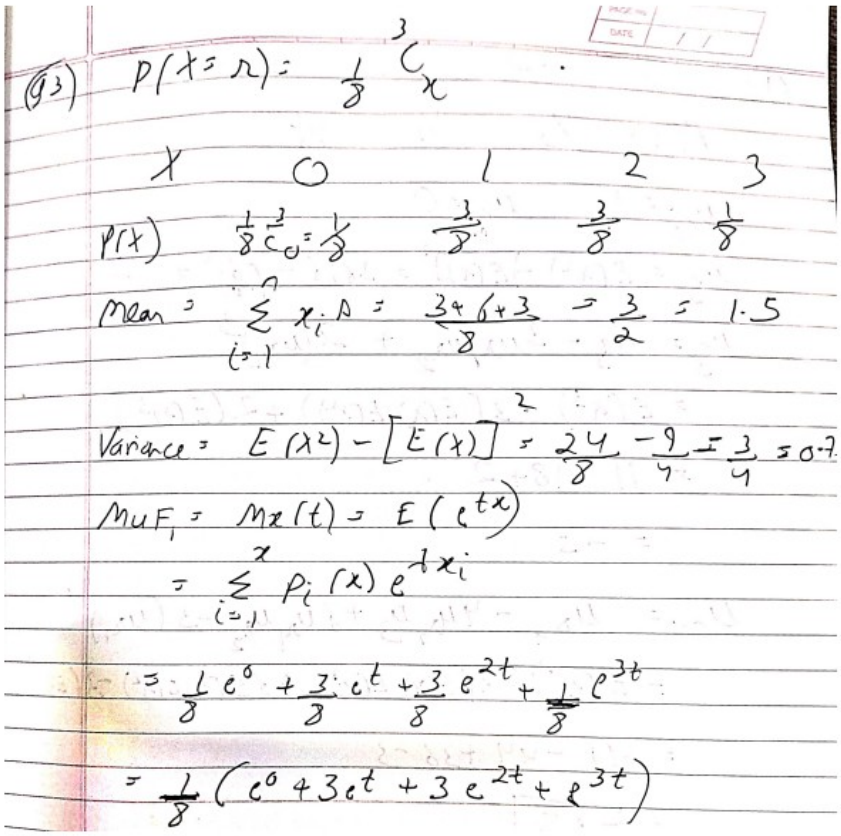
A random variable X has the probability distribution $P(X=x)=\frac{1}{8}{}^{3}C_{x}$, $X=0,1,2,3$, Find the moment generating function of X and then find mean and variance.
Write a R program for above problem.

CODE:

```
# Q 3
x=c(0,1,2,3)
p=c(1/8,3/8,3/8,1/8)
mr0=1
mr1=sum(x*p)
mr2=sum(x*x*p)
mr3=sum(x*x*x*p)
v=raw2central(c(mr0,mr1,mr2,mr3))
cat("Mean = ",mr1)
cat("variance = ",v[3])
```

OUTPUT:

```
> # Q 3
> x=c(0,1,2,3)
> p=c(1/8,3/8,3/8,1/8)
> mr0=1
> mr1=sum(x*p)
> mr2=sum(x*x*p)
> mr3=sum(x*x*x*p)
> v=raw2central(c(mr0,mr1,mr2,mr3))
> cat("Mean = ",mr1)
Mean =  1.5> cat("variance = ",v[3])
variance =  0.75
>
```



4.

Find the first four moments about mean of the random variable X whose probability mass function is given by

X:	-2	3	1
P(X):	1/3	1/2	1/6

Write a R program for above problem.

CODE:

```
# Q 4
x=c(-2,3,1)
p=c(1/3,1/2,1/6)
mr0=1
mr1=sum(x*p)
mr2=sum(x*x*p)
mr3=sum(x*x*x*p)
mr4=sum(x*x*x*x*p)
raw2central(c(mr0,mr1,mr2,mr3,mr4))
```

OUTPUT:

```
> # Q 4
> x=c(-2,3,1)
> p=c(1/3,1/2,1/6)
> mr0=1
> mr1=sum(x*p)
> mr2=sum(x*x*p)
> mr3=sum(x*x*x*p)
> mr4=sum(x*x*x*x*p)
> raw2central(c(mr0,mr1,mr2,mr3,mr4))
[1]  1  0  5 -5 35
```