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Hw1 - Q7

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```
%Student-Number : [9723042]
% University: Amirkabir University of Technology
```

clear recent data

```
clc;
close all;
clear ;
```

Initialization

for P = 1

```
res = 0.01 ; %resolution
t = -10 : res : 10 - res ;%time
m = 0;%mean of R.v
s = 1 ; %variance of Random Variable
x = (1/sqrt(2*pi*s^2))*exp(-((t - m).^2)/(2*s^2)); %unif Gaussian
N = [4,8,16,32] ; %quantization levels
```

for N = 4

```
[partition,codebook,distor] = lloyds(x,N(1)) ; %lloyds algorithm that return MSE of distortion
L = numel(x) ;
Px = sum(x.^2)/L ; %power of r.v
SQNR1 = Px /distor ; %signal to quantization noise ratio
SQNR1 = pow2db(SQNR1) ;%signal to quantization noise ratio db
```

for N = 8

```
[partition,codebook,distor] = lloyds(x,N(2)) ; %lloyds algorithm that return MSE of distortion
SQNR2 = Px /distor ; %signal to quantization noise ratio
SQNR2 = pow2db(SQNR2) ;%signal to quantization noise ratio db
```

for N = 16

```
[partition,codebook,distor] = lloyds(x,N(3)) ; %lloyds algorithm that return MSE of distortion
SQNR3 = Px /distor ; %signal to quantization noise ratio
SQNR3 = pow2db(SQNR3) ;%signal to quantization noise ratio db
```

for N = 32

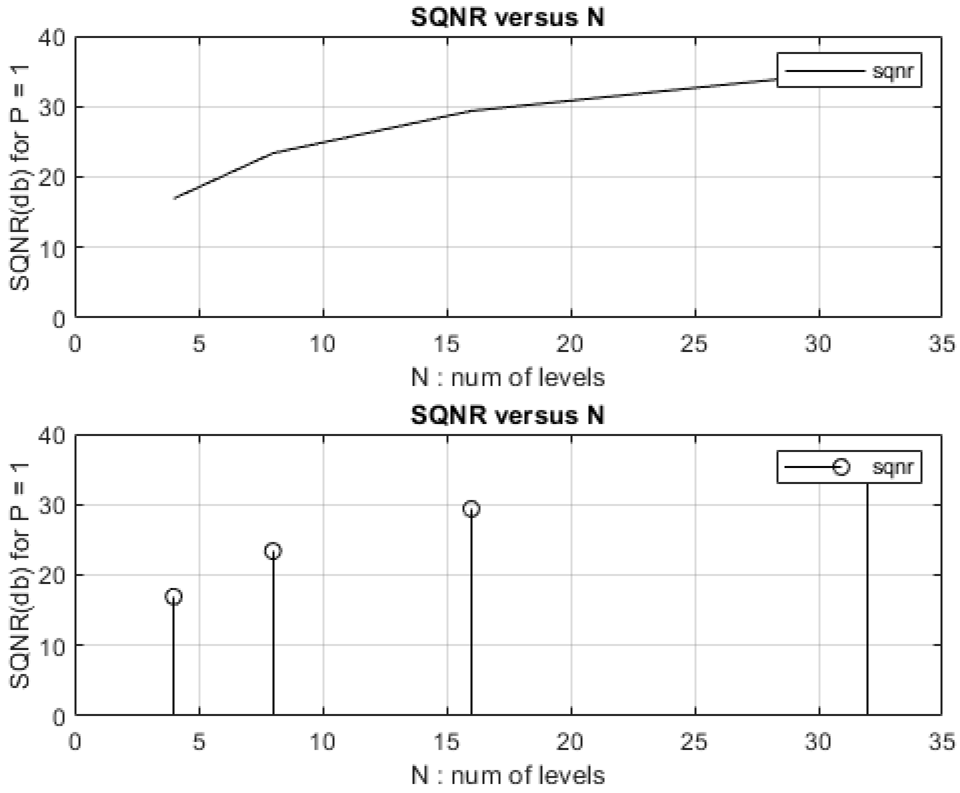
```
[partition,codebook,distor] = lloyds(x,N(4)) ; %lloyds algorithm that return MSE of distortion
SQNR4 = Px /distor ; %signal to quantization noise ratio
SQNR4 = pow2db(SQNR4) ;%signal to quantization noise ratio db
fprintf('As we increase 1 bit, 6db is added to SQNR') ;
sqnr = [SQNR1 , SQNR2,SQNR3,SQNR4]; %Sqnr vector
```

```
As we increase 1 bit, 6db is added to SQNR
```

Plotting for P = 1

```
figure(1)
subplot(211)
plot(N,sqnr,'k')
ylabel("SQNR(db) for P = 1")
xlabel("N : num of levels")
title("SQNR versus N")
legend('sqnr')
grid on;
axis([0 35 0 40])
subplot(212)
stem(N,sqnr,'k')
ylabel("SQNR(db) for P = 1")
xlabel("N : num of levels")
```

```
title("SQNR versus N")
legend('sqnr')
grid on;
axis([0 35 0 40])
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```



for P = 5

```
clc;
res = 0.01 ; %resolution
t = -10 : res : 10 - res ;%time
m = 0;%mean of R.v
s = 5 ; %variance of Random Variable
x = (1/sqrt(2*pi*s^2))*exp(-((t - m).^2)/(2*s^2)); %unif Gaussian
N = [4,8,16,32] ; %quantization levels
```

for N = 4

```
[partition,codebook,distor] = lloyds(x,N(1)) ; %lloyds algorithm that
 return MSE of distortion
L = numel(x) ;
Px = sum(x.^2)/L ; %power of r.v
SQNR1 = Px /distor ; %signal to quantization noise ratio
SQNR1 = pow2db(SQNR1) ;%signal to quantization noise ratio db
```

for N = 8

```
[partition,codebook,distor] = lloyds(x,N(2)) ; %lloyds algorithm that
 return MSE of distortion
SQNR2 = Px /distor ; %signal to quantization noise ratio
SQNR2 = pow2db(SQNR2) ;%signal to quantization noise ratio db
```

for N = 16

```
[partition,codebook,distor] = lloyds(x,N(3)) ; %lloyds algorithm that
 return MSE of distortion
SQNR3 = Px /distor ; %signal to quantization noise ratio
SQNR3 = pow2db(SQNR3) ;%signal to quantization noise ratio db
```

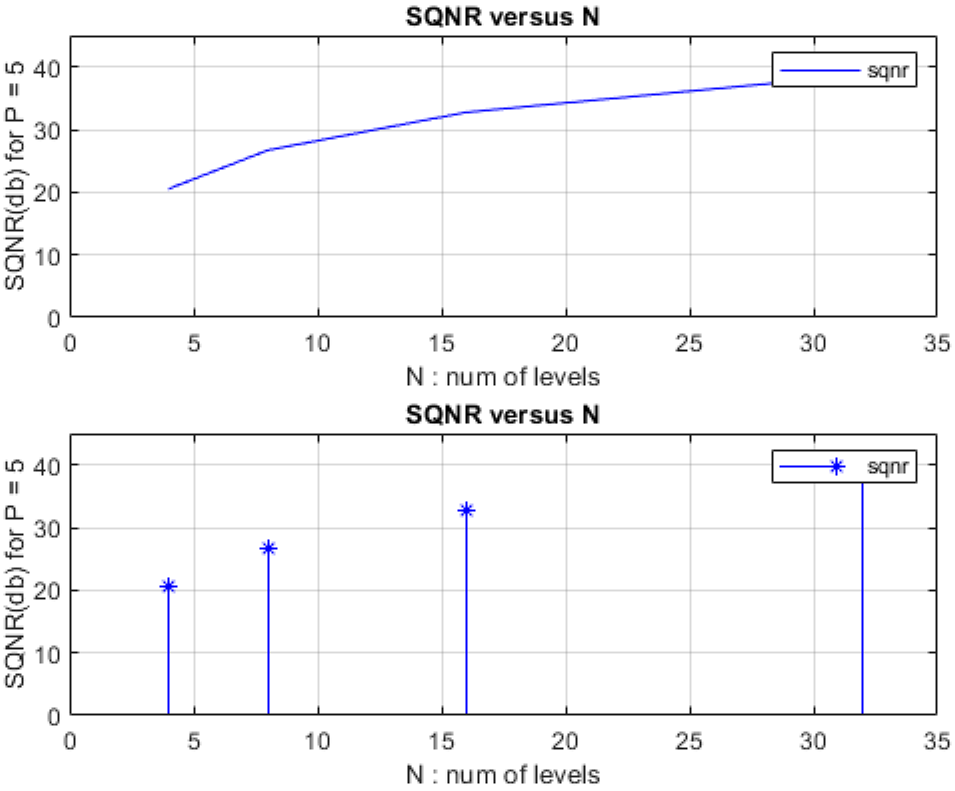
for N = 32

```
[partition,codebook,distor] = lloyds(x,N(4)) ; %lloyds algorithm that
 return MSE of distortion
SQNR4 = Px /distor ; %signal to quantization noise ratio
SQNR4 = pow2db(SQNR4) ;%signal to quantization noise ratio db
fprintf('As we increase 1 bit, 6db is added to SQNR') ;
sqnr = [SQNR1 , SQNR2,SQNR3,SQNR4]; %Sqnr vector
```

```
As we increase 1 bit, 6db is added to SQNR
```

Plotting for P = 5

```
figure(2)
subplot(211)
plot(N,sqnr,'b')
ylabel("SQNR(db) for P = 5")
xlabel("N : num of levels")
title("SQNR versus N")
legend('sqnr')
grid on;
axis([0 35 0 45])
subplot(212)
stem(N,sqnr,'b*')
ylabel("SQNR(db) for P = 5")
xlabel("N : num of levels")
title("SQNR versus N")
legend('sqnr')
grid on;
axis([0 35 0 45])
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```



for P = 10

```
clc;
res = 0.01 ; %resolution
t = -10 : res : 10 - res ;%time
m = 0;%mean of R.v
s = 10 ; %variance of Random Variable
x = (1/sqrt(2*pi*s^2))*exp(-((t - m).^2)/(2*s^2)); %unif Gaussian
N = [4,8,16,32] ; %quantization levels
```

for N = 4

```
[partition,codebook,distor] = lloyds(x,N(1)) ; %lloyds algorithm that
 return MSE of distortion
L = numel(x) ;
Px = sum(x.^2)/L ; %power of r.v
SQNR1 = Px /distor ; %signal to quantization noise ratio
SQNR1 = pow2db(SQNR1) ;%signal to quantization noise ratio db
```

for N = 8

```
[partition,codebook,distor] = lloyds(x,N(2)) ; %lloyds algorithm that
 return MSE of distortion
SQNR2 = Px /distor ; %signal to quantization noise ratio
```

```
SQNR2 = pow2db(SQNR2) ;%signal to quantization noise ratio db
```

for N = 16

```
[partition,codebook,distor] = lloyds(x,N(3)) ; %lloyds algorithm that
 return MSE of distortion
SQNR3 = Px /distor ; %signal to quantization noise ratio
SQNR3 = pow2db(SQNR3) ;%signal to quantization noise ratio db
```

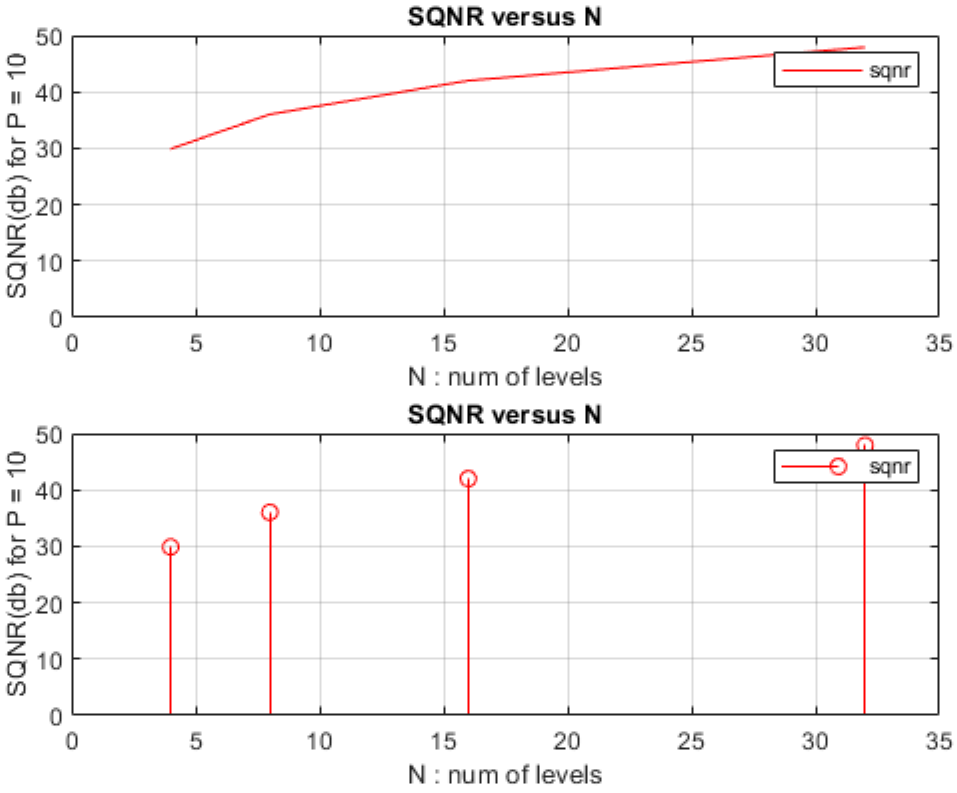
for N = 32

```
[partition,codebook,distor] = lloyds(x,N(4)) ; %lloyds algorithm that
 return MSE of distortion
SQNR4 = Px /distor ; %signal to quantization noise ratio
SQNR4 = pow2db(SQNR4) ;%signal to quantization noise ratio db
fprintf('As we increase 1 bit, 6db is added to SQNR') ;
sqnr = [SQNR1 , SQNR2,SQNR3,SQNR4]; %Sqnr vector
```

```
As we increase 1 bit, 6db is added to SQNR
```

Plotting for P = 10

```
figure(3)
subplot(211)
plot(N,sqnr,'r -')
ylabel("SQNR(db) for P = 10")
xlabel("N : num of levels")
title("SQNR versus N")
legend('sqnr')
grid on;
axis([0 35 0 50])
subplot(212)
stem(N,sqnr,'r -')
ylabel("SQNR(db) for P = 10")
xlabel("N : num of levels")
title("SQNR versus N")
legend('sqnr')
grid on;
axis([0 35 0 50])
```



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