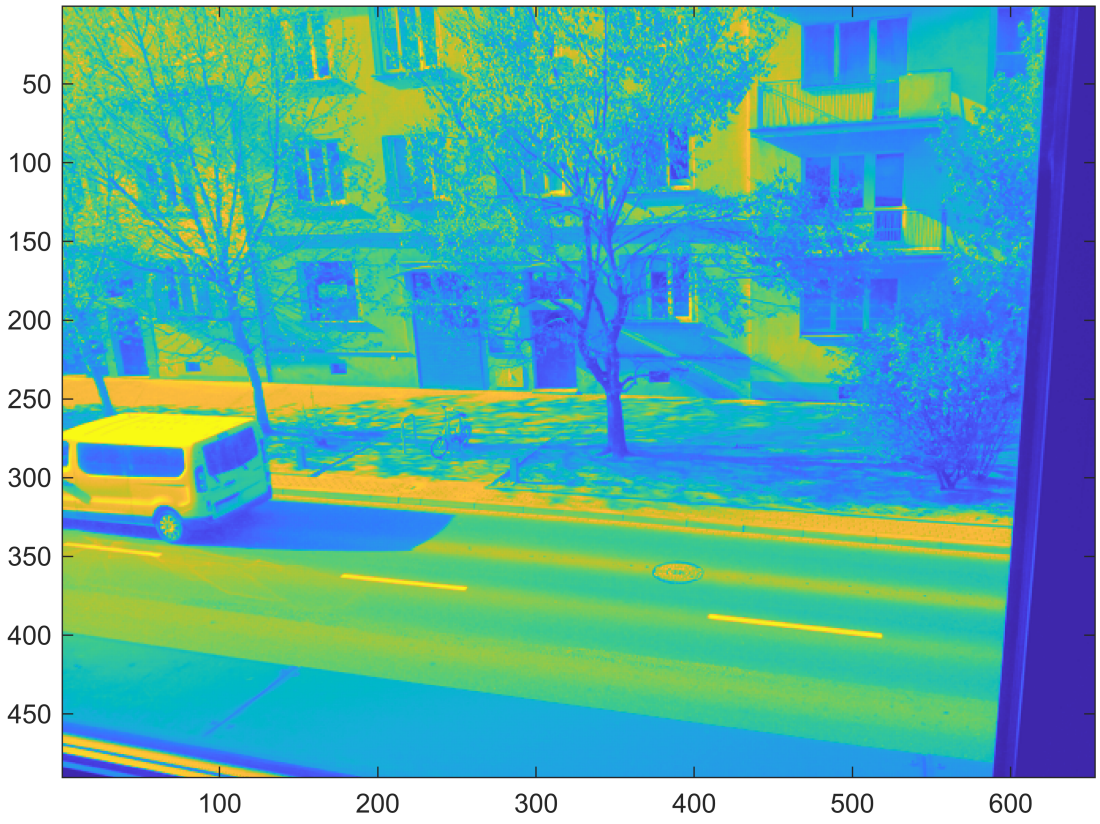
Laboratory 9

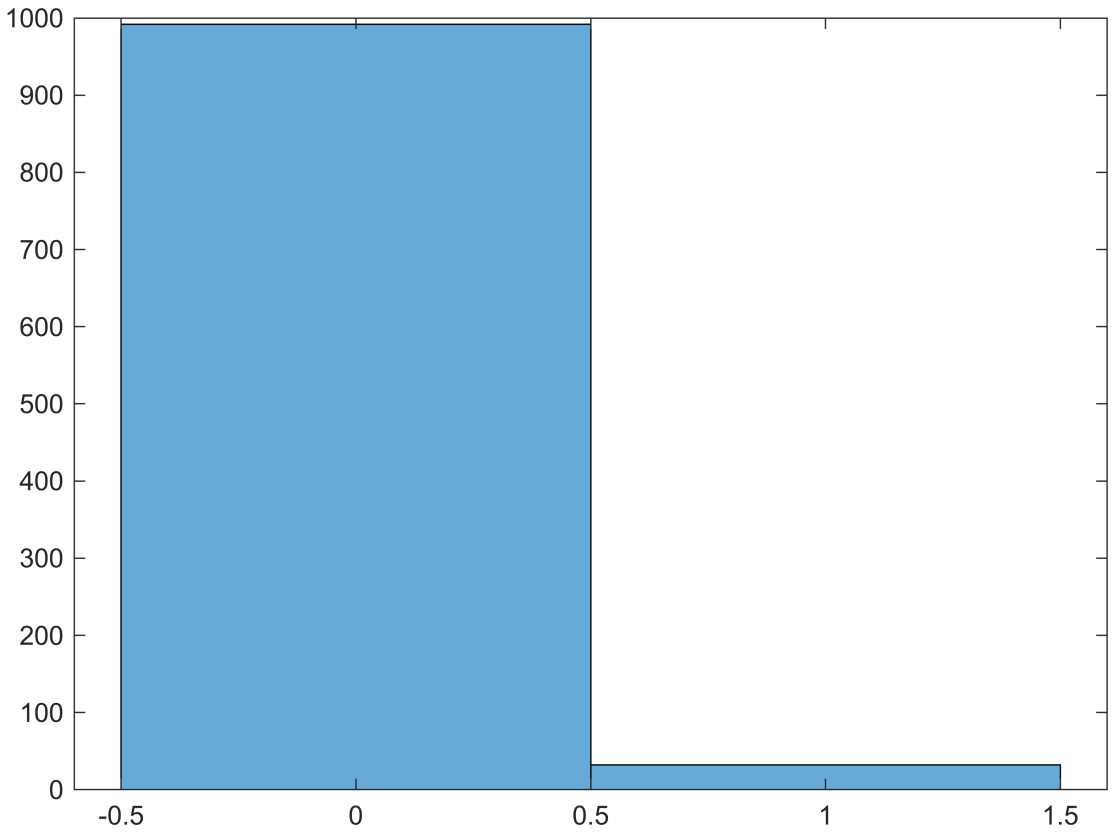
Exercise 0

```
tab4 = importdata("tab_4.mat");
imshow(tab4);
```

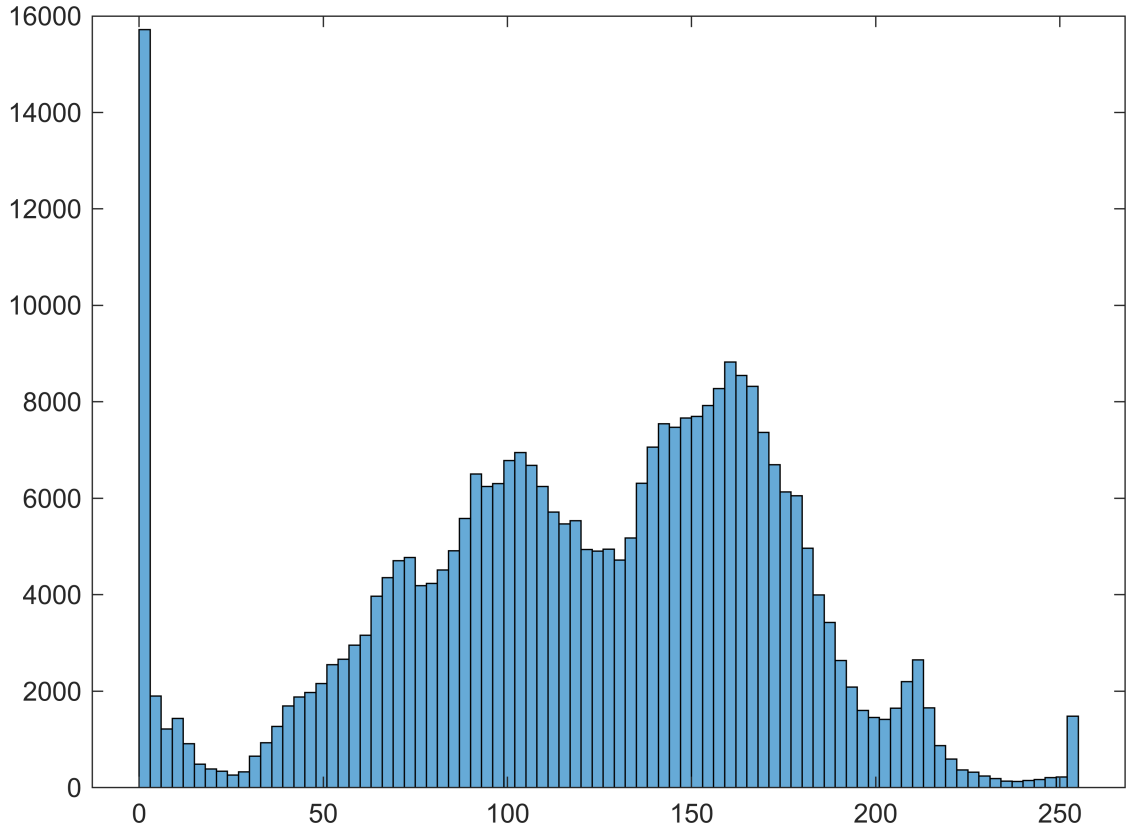
```
imagesc(tab4);
```




```
I = eye(32);
histogram(I)
```




```
histogram(tab4)
```



Exercise 1

```
tab4_mean = mean(tab4)
```

```
tab4_mean = 1×653
  141.3163  140.6286  140.8653  142.2347  148.6102  148.2612  146.5143  148.1776 ···
```

```
tab4_totatmean = mean(tab4, 'all')
```

```
tab4_totatmean = 120.2999
```

```
tab4_std = std(double(tab4))
```

```
tab4_std = 1×653
   47.6879   48.5808   48.9055   48.1426   49.2023   49.6135   49.6761   49.0572 ···
```

```
A = [1 2 3;4 5 6];
A(:);
find(A==3);
find(A(:)==3);
ind = find(A==3);
[rows_ind columns_ind] = find(A==3);
[rows_ind_a columns_ind_a] = find(A(:)==3);
A(rows_ind(1), columns_ind(1));
A(ind(1));
```

```
%A(rows_ind_a(1), columns_ind_a(1)) % error. Why?
size(A); % this is why. row index > rows in matrix
found_indeices = find(tab4 < 2*tab4_mean)
```

```
found_indeices = 315840×1
     1
     2
     3
     4
     5
     6
     7
     8
     9
    10
     ⋮
```

```
tab4(found_indeices)
```

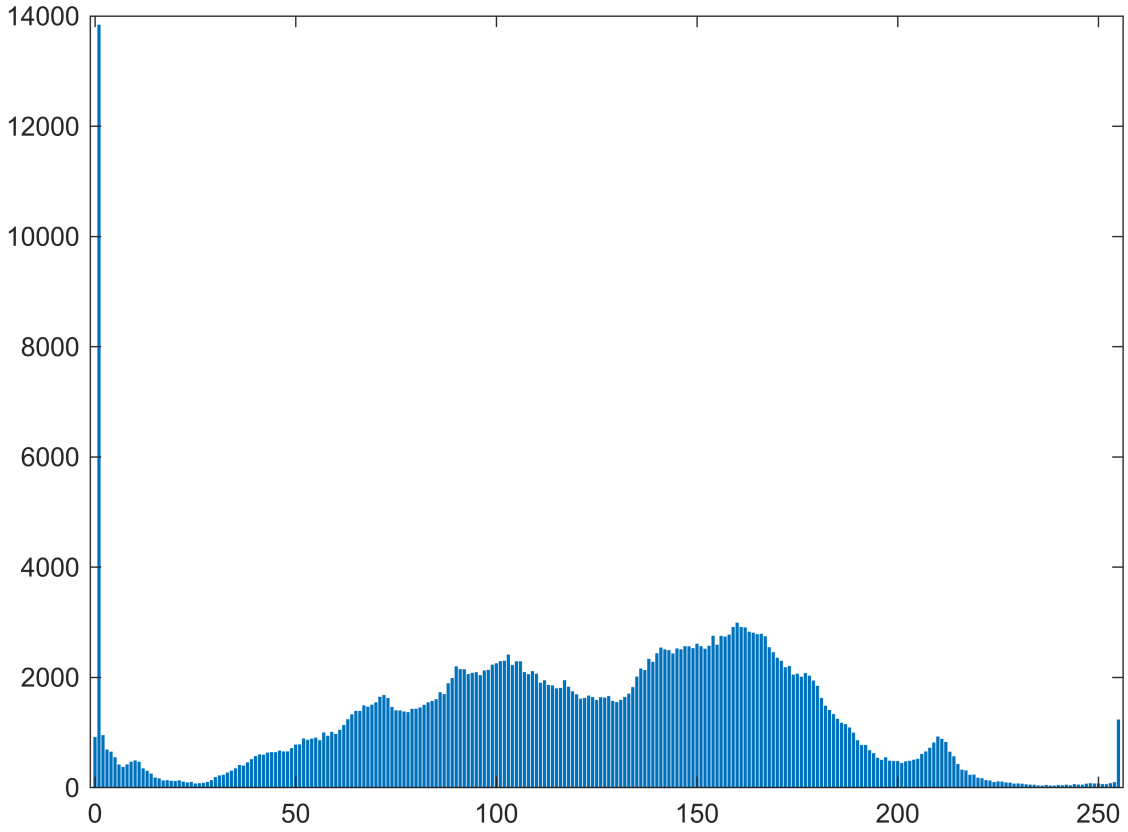
```
ans = 315840×1 uint8 column vector
   195
   181
   157
   167
   169
   176
   181
   182
   219
   190
     ⋮
```

```
reset_tab4 = tab4;
reset_tab4(found_indeices) = 0
```

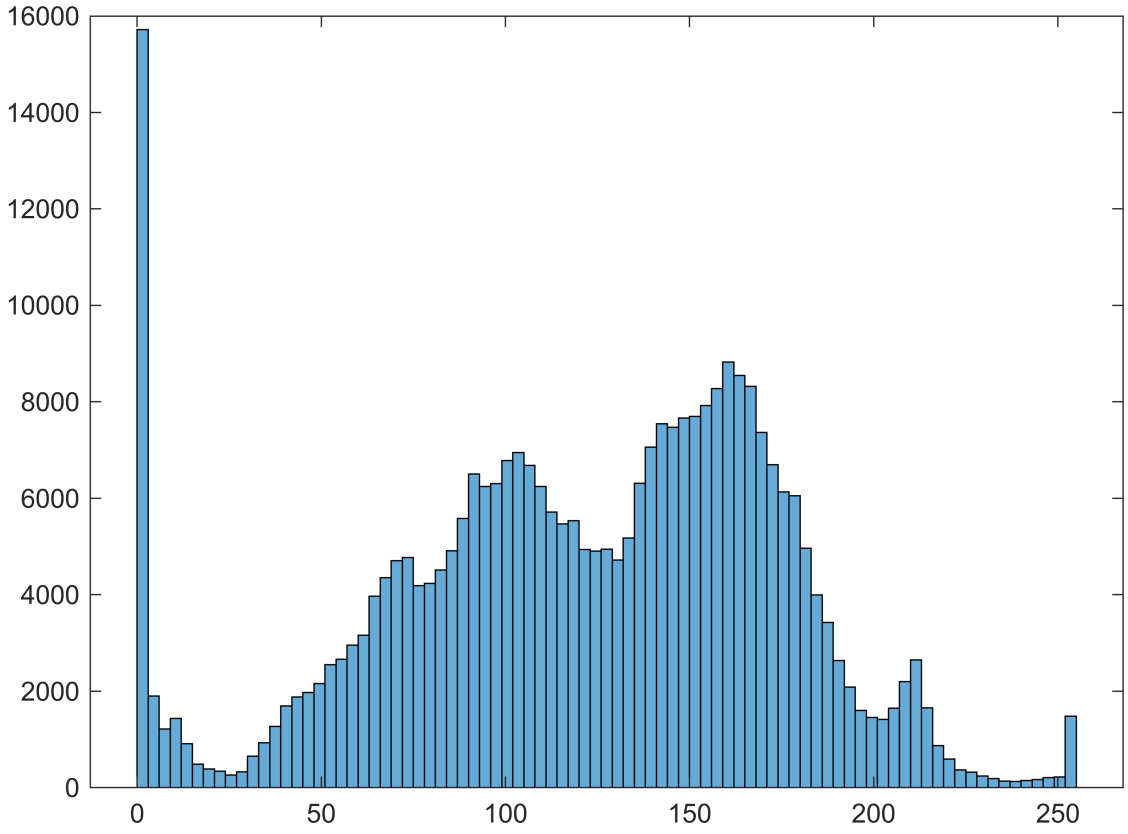
```
reset_tab4 = 490×653 uint8 matrix
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 ⋯
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
     ⋮
```

Exercise 2

```
tab4;
[unique_elements, unique_index, tab_index] = unique(tab4);
element_count = zeros(size(unique_elements));
for k = 1:size(element_count)
    element_count(k) = size(find(tab4 == unique_elements(k)),1);
end
bar(unique_elements, element_count)
```

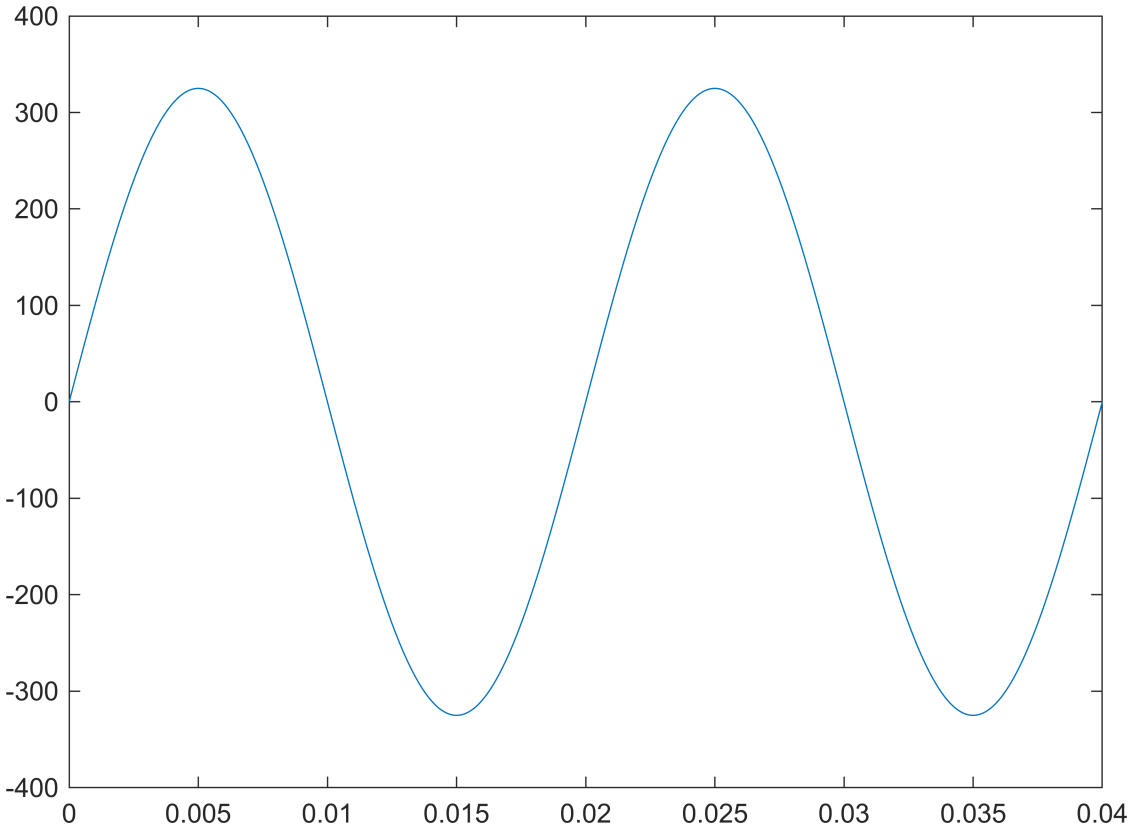



```
histogram(tab4)
```



Exercise 3

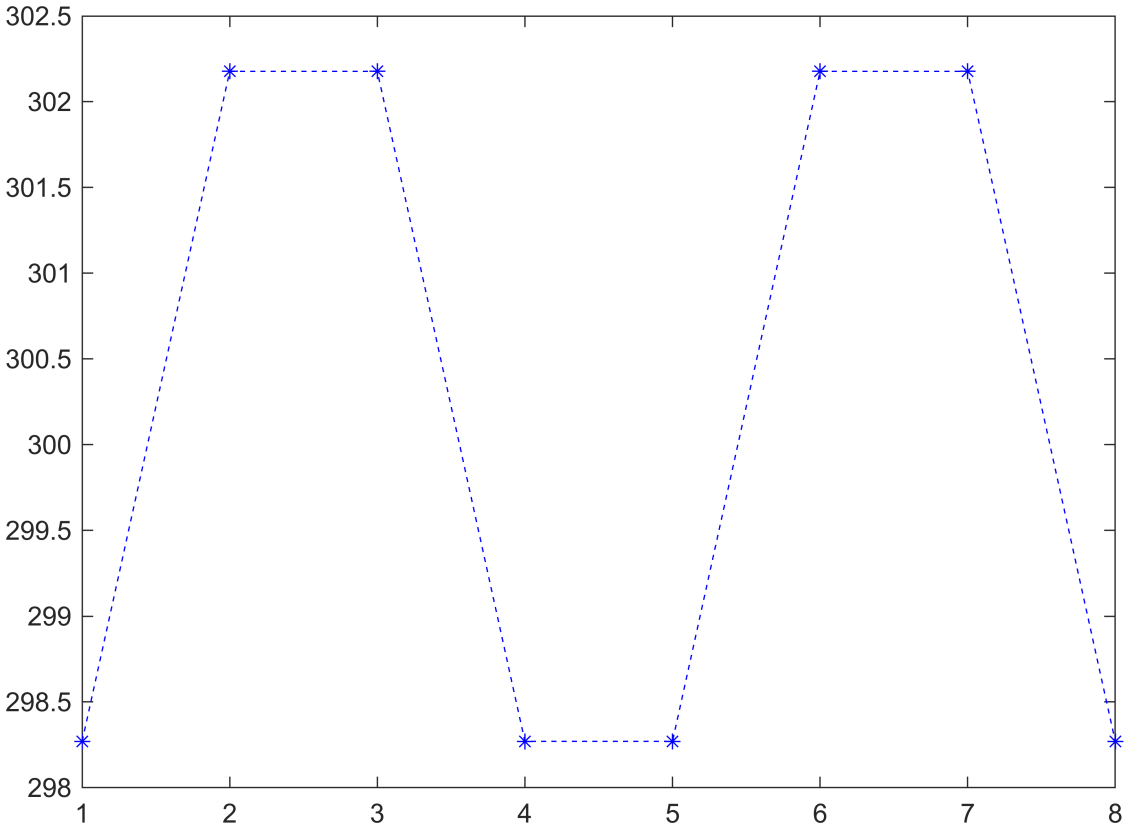
```
amplitude = 325;
frequency = 50;
dt = 0.0001;
t = 0:dt:0.04;
x = amplitude * sin(2*pi*frequency*t);
plot(t, x);
```




```
points = find(abs(x-300) < 5)
```

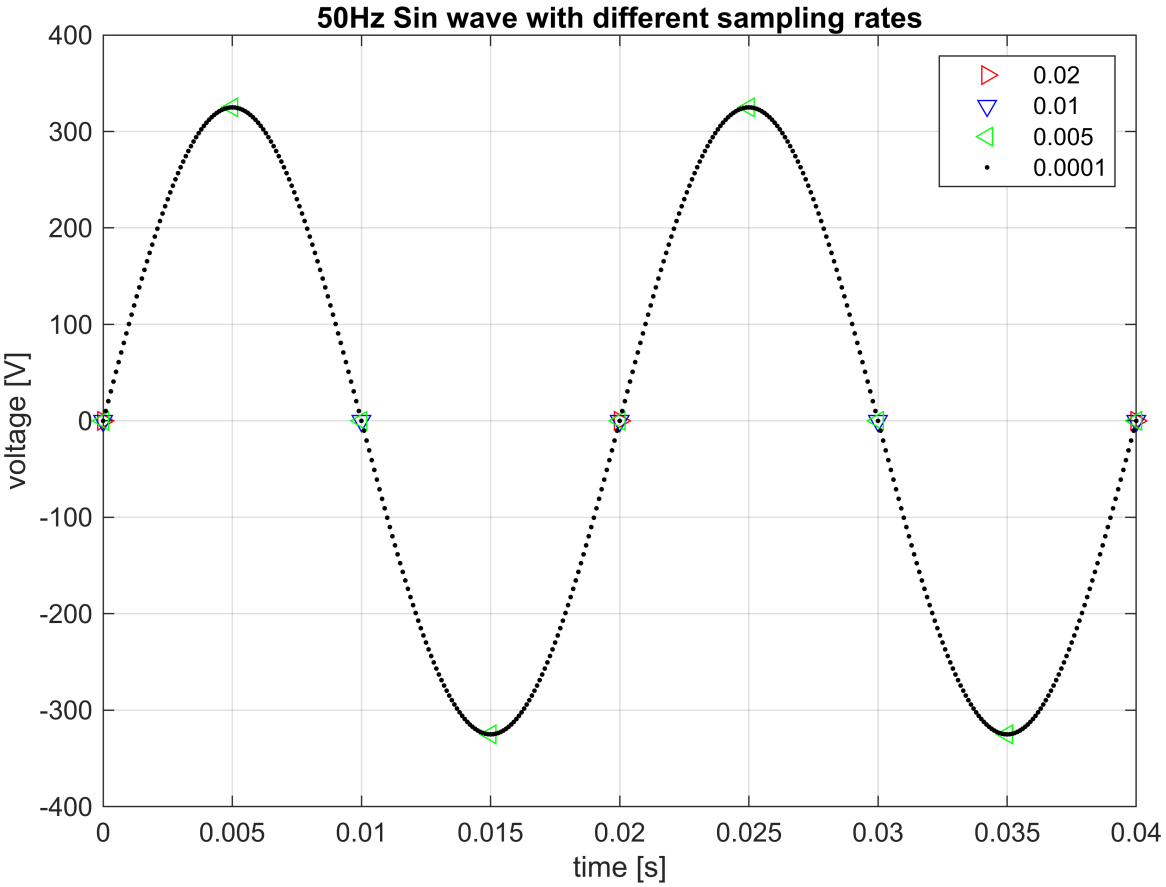
```
points = 1×8
    38    39    63    64   238   239   263   264
```

```
plot(x(points), '--*b')
```



Exercise 3b

```
amplitude = 325;
frequency = 50;
dt = [0.02, 0.01, 0.005, 0.0001];
ta = 0:dt(1):0.04;
tb = 0:dt(2):0.04;
tc = 0:dt(3):0.04;
td = 0:dt(4):0.04;
xa = amplitude * sin(2*pi*frequency*ta);
xb = amplitude * sin(2*pi*frequency*tb);
xc = amplitude * sin(2*pi*frequency*tc);
xd = amplitude * sin(2*pi*frequency*td);
plot(ta, xa, '>r'); hold on;
plot(tb, xb, 'vb');
plot(tc, xc, '<g');
plot(td, xd, '.k');
title('50Hz Sin wave with different sampling rates')
legend('0.02', '0.01', '0.005', '0.0001')
xlabel('time [s]')
ylabel('voltage [V]')
grid on
```


50Hz Sin wave with different sampling rates
400
300
200
100
0
-100
-200
-300
-400
voltage [V]
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
time [s]
0.02
0.01
0.005
0.0001