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TASK 1)

```
clc;
clear;
close all;

I = imread("flower.jpg");
% Convert to double precision
I = im2double(I);
% Display
figure;
imshow(I);
```

```
whos I;
```

```
  Name        Size                Bytes  Class     Attributes

  I         500x351x3           4212000  double
```

```
[R, G, B] = imsplit(I);
whos R;
```

```
  Name        Size              Bytes  Class     Attributes

  R         500x351           1404000  double
```

```
W = 5;
h = ones(W) ./ W .^ 2;
Ravg = conv2(R, h, "same");
% Convolve G with h to blur the image
Gavg = conv2(G, h, "same"); %Write your code here
% Convolve B with h to blur the image
Bavg = conv2(B, h, "same"); %Write your code here
% Concatenate the three matrices to put together the color image
Iavg = cat(3, Ravg, Gavg, Bavg);
whos Iavg;
```

```
  Name        Size                Bytes  Class     Attributes

  Iavg      500x351x3           4212000  double
```

```
imshow(Iavg,[]);
```

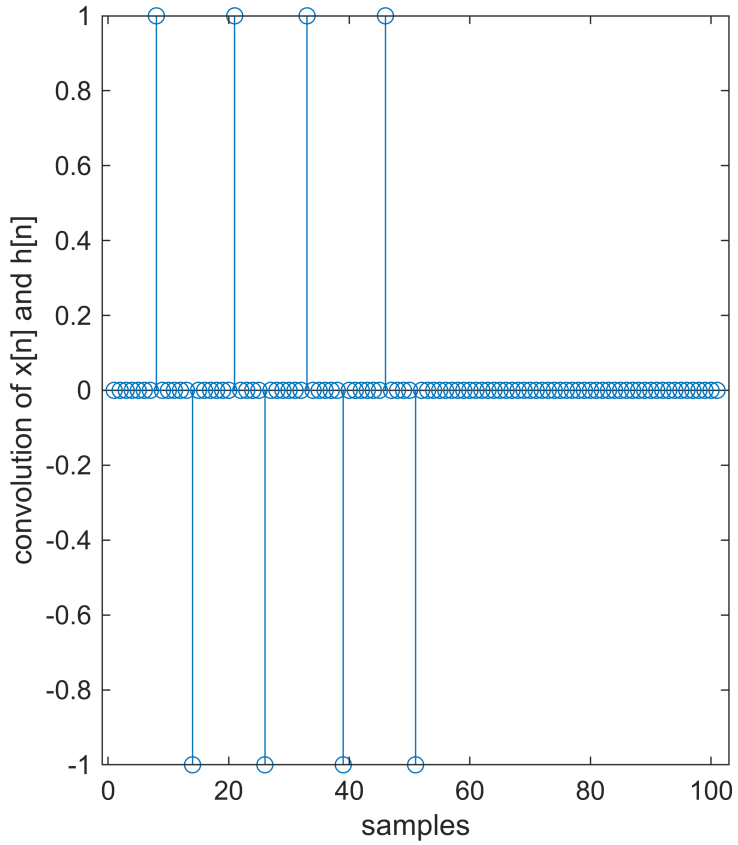
TASK 2)

```
n = 0:50;
x_n = double((sin(0.5*n)+0.2) < 0);
impulse_n = n == 0;
impulse_n_1 = n == 1;

h_n = impulse_n - impulse_n_1;

y = conv(x_n, h_n);

stem(y);
ylabel("convolution of x[n] and h[n]");
xlabel("samples");
```



TASK 3)

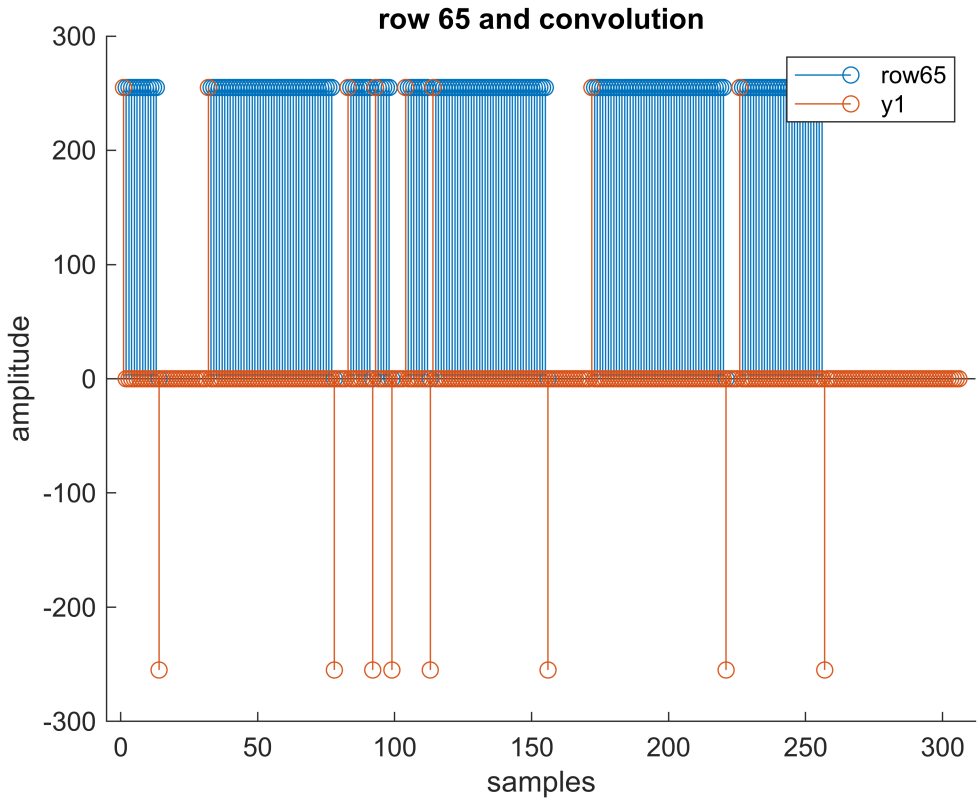
```
load echart.mat;
row_65 = echart(65,:);
y = conv(row_65, h_n);

figure;
hold on;

stem(row_65);
```

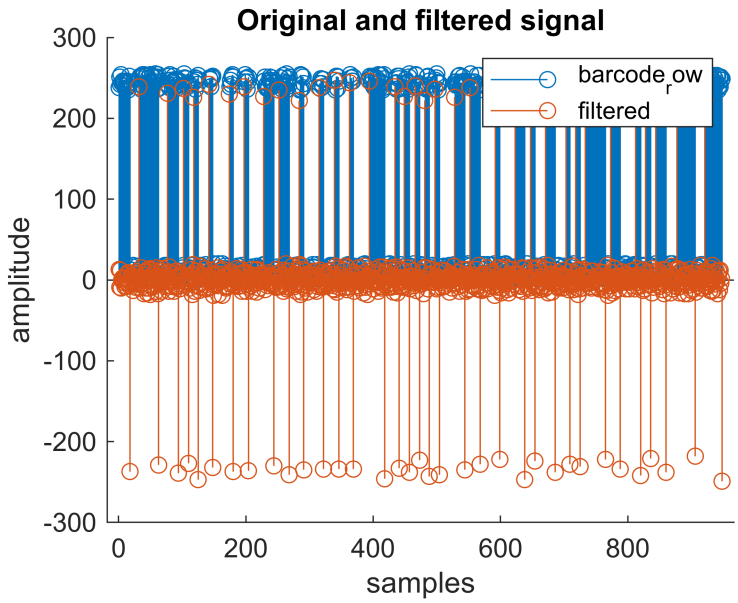
```
stem(y);

title("row 65 and convolution");
xlabel("samples");
ylabel("amplitude");
legend(["row65", "y1"]);
hold off;
```

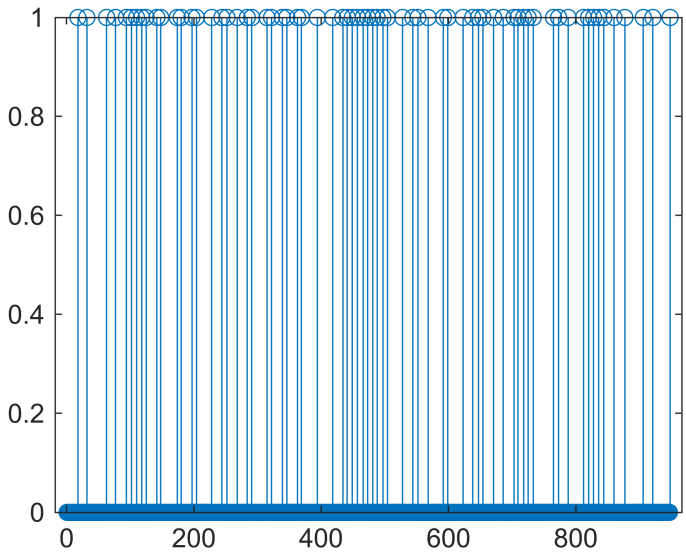


TASK 4)

```
% 1)
barcode = imread("HP110v3.png");
[rows, cols] = size(barcode);
middle_row_index = round(rows / 2);
row = barcode(middle_row_index,:);
h_n = [1, -1];
% 2)
filtered = conv(row, h_n, "same");
figure;
hold on;
stem(row);
stem(filtered);
title("Original and filtered signal");
xlabel("samples");
ylabel("amplitude");
legend(["barcode_row", "filtered"]);
```




```
% 3)
% It can be because all the lines are not completely stright. Some have
% bumps
d_n = abs(filtered) >= 200;
figure;
stem(d_n);
```




```
%4)
l_n = find(d_n);
% find returns indices where the input function is not 0

delta_n = conv(l_n, h_n, "same");
disp(delta_n);
```

```
    14    31    14    17     8     8     8     7    17     6    26     6    17     7    24    16     8    16    16
```

```
valid = delta_n(1:59);
total_width = sum(valid);
Q = total_width / 95;
% a_Q where 1 <= a <= 4
a_Q = round(delta_n / Q);
start_index = find(a_Q == 1, 1, "first");
end_index = start_index + 58;
a_Q = a_Q(start_index, end_index)
```

```
Index in position 1 exceeds array bounds. Index must not exceed 1.
```

```
decoded = decodeUPC(a_Q);
disp(decoded);

% Plot the fixed widths
figure;
stem(a_Q);
title("Fixed bar widths (multiples of θ)");
xlabel("bar index");
ylabel("width (1, 2, 3, or 4)");
```