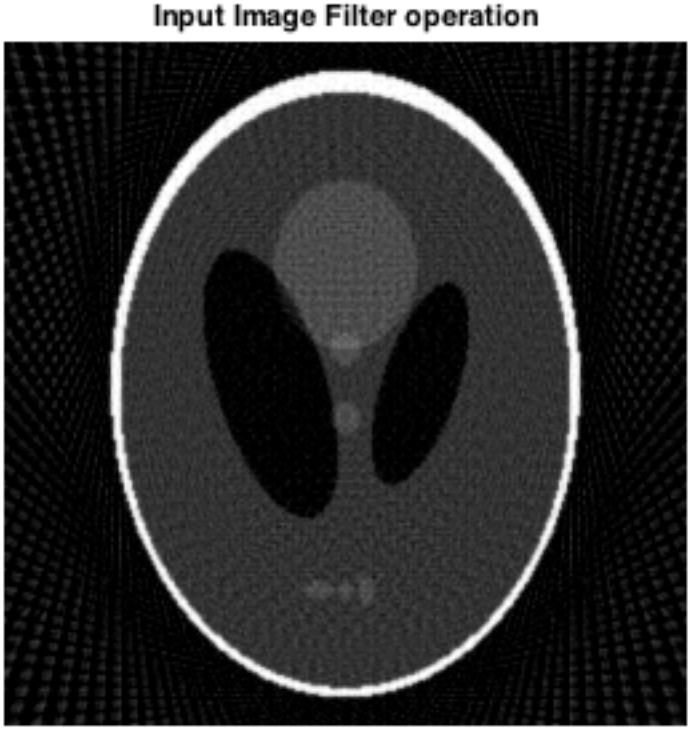
Question 2b

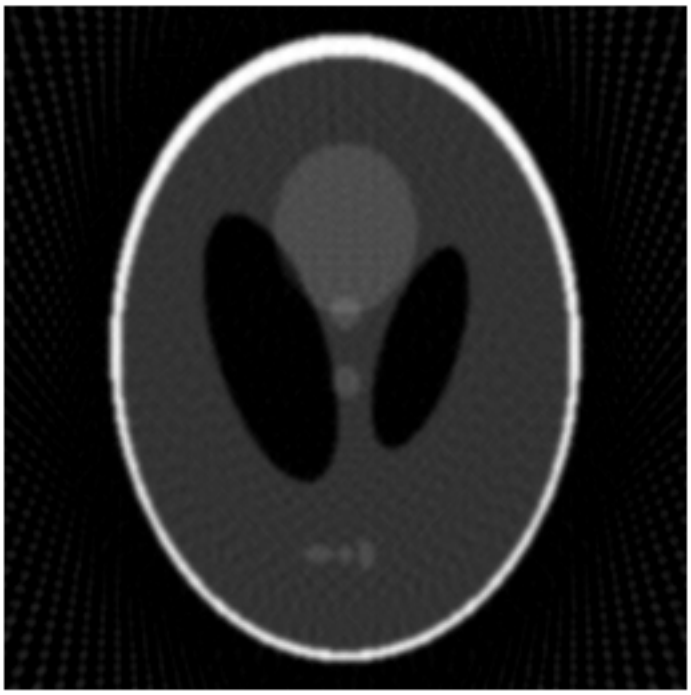
```
S0 = phantom(256);
mask = fspecial ('gaussian', 11, 1);
S1 = conv2 (S0, mask, 'same');
mask = fspecial ('gaussian', 51, 5);
S5 = conv2 (S0, mask, 'same');
% Note S1 is blurred with Gaussian of sigma 1, S5 is blurred with sigma 5

figure();
subplot(1,3,1), imshow(S0), title('Input image')
subplot(1,3,2), imshow(S1), title('Smoothed with gaussian sigma 1')
subplot(1,3,3), imshow(S5), title('Smoothed with gaussian sigma 5')

input_array = [S0, S1, S5];
theta = 0:3:177;
for i = 1:3
    if (i==1)
        image = S0;
        title_name = 'Input Image Filter operation';
        a_number = 0;
    elseif (i==2)
        image = S1;
        title_name = 'S1 smoothed Image Filter operation';
        a_number = 1;
    elseif (i==3)
        image = S5;
        title_name = 'S5 smoothed Image Filter operation';
        a_number = 5;
    end
    [A] = radon(image, theta);
    extracted_image = iradon(A, theta, 'linear', 'Ram-Lak', 1.0, size(image,1));
    figure(); imshow(extracted_image); title(title_name)
    % RRMSE calculation
    RRMSE = sqrt(sum(sum((extracted_image - image).^2)))/sqrt(sum(sum(image.^2)));
    fprintf('The value of RRMSE for image S%d is %d \n', a_number, RRMSE);
end
```

```
The value of RRMSE for image S0 is 2.901437e-01
The value of RRMSE for image S1 is 1.273430e-01
The value of RRMSE for image S5 is 1.912536e-02
```


Input image
Smoothed with gaussian sigma 1
Smoothed with gaussian sigma 5


Input Image Filter operation

S1 smoothed Image Filter operation



S5 smoothed Image Filter operation

Observation

- We observe that RRMSE for image S0>S1>S5
- Basically, as the image gets more smoothed and smoothed, the RRMSE is decreased.
- This is exactly as we would predict since as we smooth the image with a Gaussian filter, the edges in the image become weak and the noise content also goes down.
- Because of these 2 reasons, the inverse radon performs much better. This is because the Ram Lak Filter is a linear filter and cuts off frequencies higher than a certain threshold. So if the input image does not have those higher frequency components, then the reconstructed error will be less. Noise and sharp edges introduce high frequencies. Hence the error was maximum for image S0. But since image S5 is the smoothest, the error for it is the least.

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