4.30 Let $h(k)$ and $x(k)$ be two N-point white noise signals uniformly distributed over $[-1, 1]$. Recall that the MATLAB function *conv* can be used to compute direct linear convolution. Write a MATLAB script which uses *tic* and *toc* to compute the computational time, t_{dir}, of *conv* and the computational time, t_{fast}, of the FDSP toolbox funtion *f_conv* for the cases $N = 4096$, $N = 8192$, and $N = 16384$.

(a) Print the two computational times t_{dir} and t_{fast} for $N = 4096, 8192, 16384$.

(b) Plot t_{dir} vs. $N/1024$ and t_{tast} vs. $N/1024$ on the same graph and include a legend.

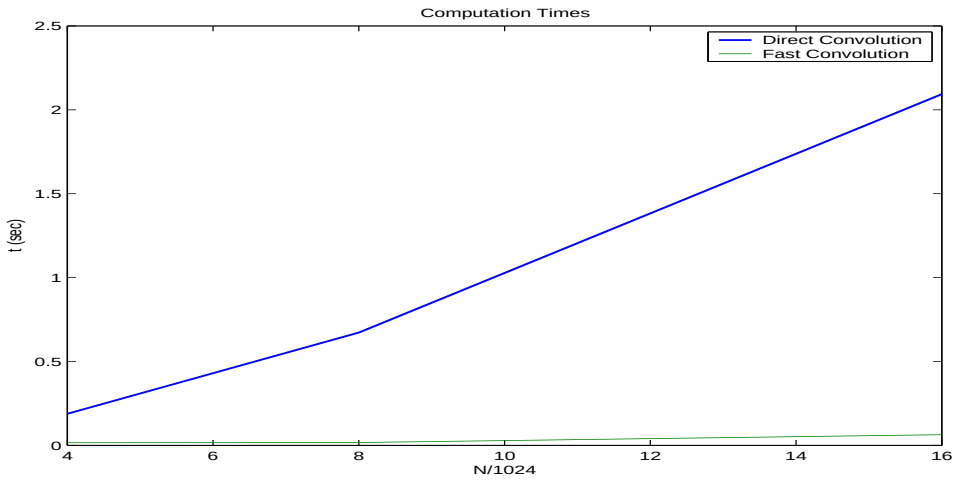
Solution

```
% Problem 4.30

% Iniitialize

clc
clear
n = 3;
N = zeros(n,1);
t_dir = zeros(n,1);
t_fast = zeros(n,1);

% Compute convolutions

hw = waitbar (0,'Computing Convolutions');
for i = 1 : n
    N(i) = floor(2^(11+i));
    h = f_randu (N(i),1,-1,1);
    x = f_randu (N(i),1,-1,1);
    tic
    y = conv(h,x);
    t_dir(i) = toc;
    tic
    y = f_conv(h,x,0);
    t_fast(i) = toc;
    waitbar (i/n,hw)
end
close(hw)

t_dir
t_fast

% Plot results

figure
hp = plot (N/1024,t_dir,N/1024,t_fast);
set (hp(1),'LineWidth',1.5)
```

```
f_labels ('Computation Times','N/1024','t (sec)')
legend ('Direct Convolution','Fast Convolution')
f_wait
```

(a) The output from the MATLAB script is

```
t_dir =
    0.1250
    0.5310
    2.5940
t_fast =
    0.0160
    0.0310
    0.0470
```



(b) Computational Times for Two Implementations of Linear Convolution