PDE: \( u_{tt} = c^2 u_{xx} \)
BCs: \( u(0, t) = u(1, t) = 0 \)
IC: \( u(x, 0) = f(x) \)
IC: \( u_t(x, 0) = 0 \)

Odd Extension: \( F(x) = \sum_{n=1}^{\infty} A_n \sin(n\pi x) \)
IC: \( u(x, 0) = \frac{1}{2} F(x) + \frac{1}{2} F(x) \)
Solution: \( u(x, t) = \frac{1}{2} F(x - ct) + \frac{1}{2} F(x + ct) \)
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IC: \[ u(x, 0) = \frac{1}{2} F(x) + \frac{1}{2} F(x) \]

Solution: \[ u(x, t) = \frac{1}{2} F(x - ct) + \frac{1}{2} F(x + ct) \]
How to Code the Odd Extension (Never need to compute Fourier coefficients)

```matlab
% IC f(x): 0 <= x <= 1
function y=f(x)
    for i=1:length(x)
        if x(i)>0.375 & x(i)<0.625
            y(i) = 0.5*(cos(8*pi*(x(i)-(1/2)))+1);
        else
            y(i) = 0;
        end
    end
end

% Odd Ext of f(x): -infinity < x < infinity
function y=F(x)
    for i = 1:length(x)
        z_integer = floor(x(i));    % int part
        z_decimal = x(i) - z_integer; % dec part

        if mod(z_integer,2)==0
            z = z_decimal;    % z_integer is even
        else
            z = z_decimal - 1; % z_integer is odd
        end

        if z>=0
            y(i) = f(z);    % NOTE: 0 <= z <= 1
        else
            y(i) = -f(-z); % NOTE: -1 <= z < 0
        end
    end
end
```