MAE/MSE 502, Spring 2022 HW3 Solution

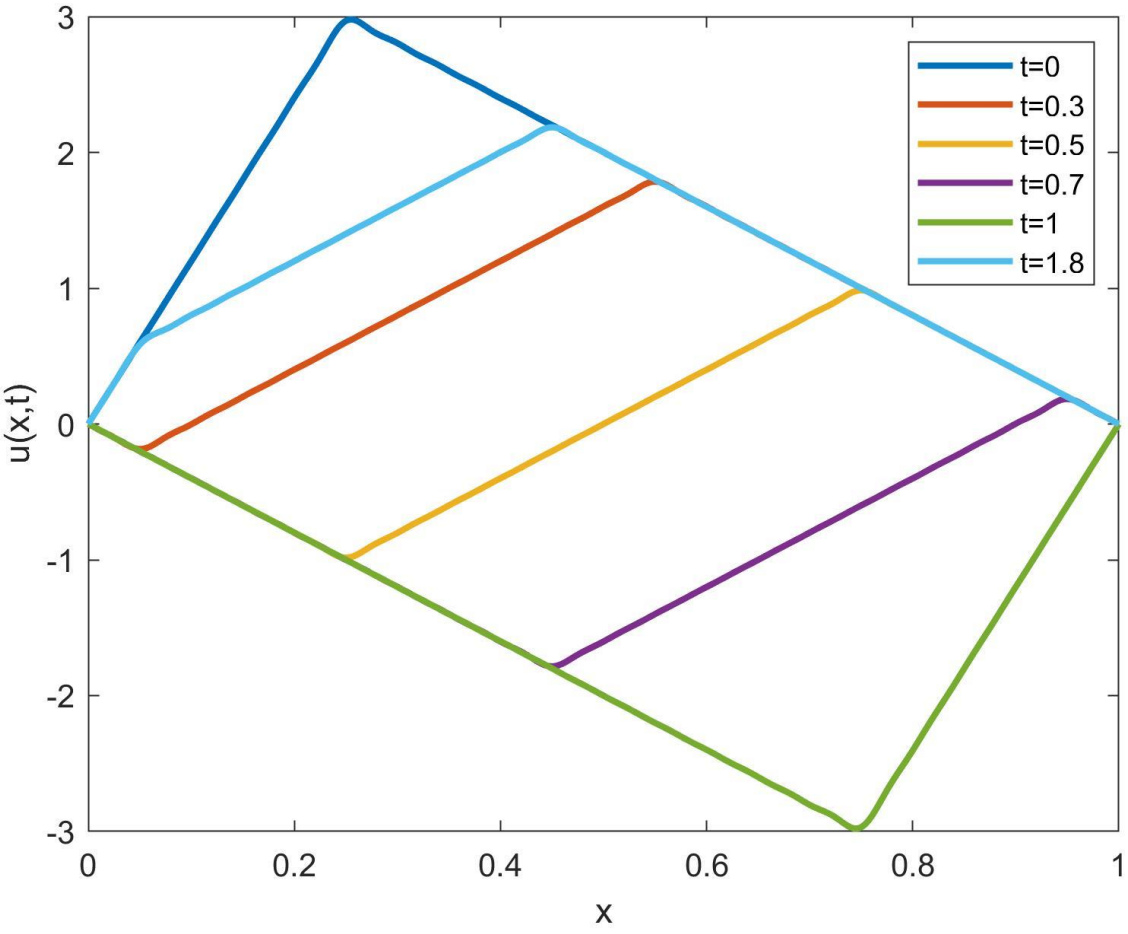
Problem 1

$$u(x,t) = \sum_{n=1}^{\infty} a_n \sin(n\pi x)\cos(n\pi t)$$

where

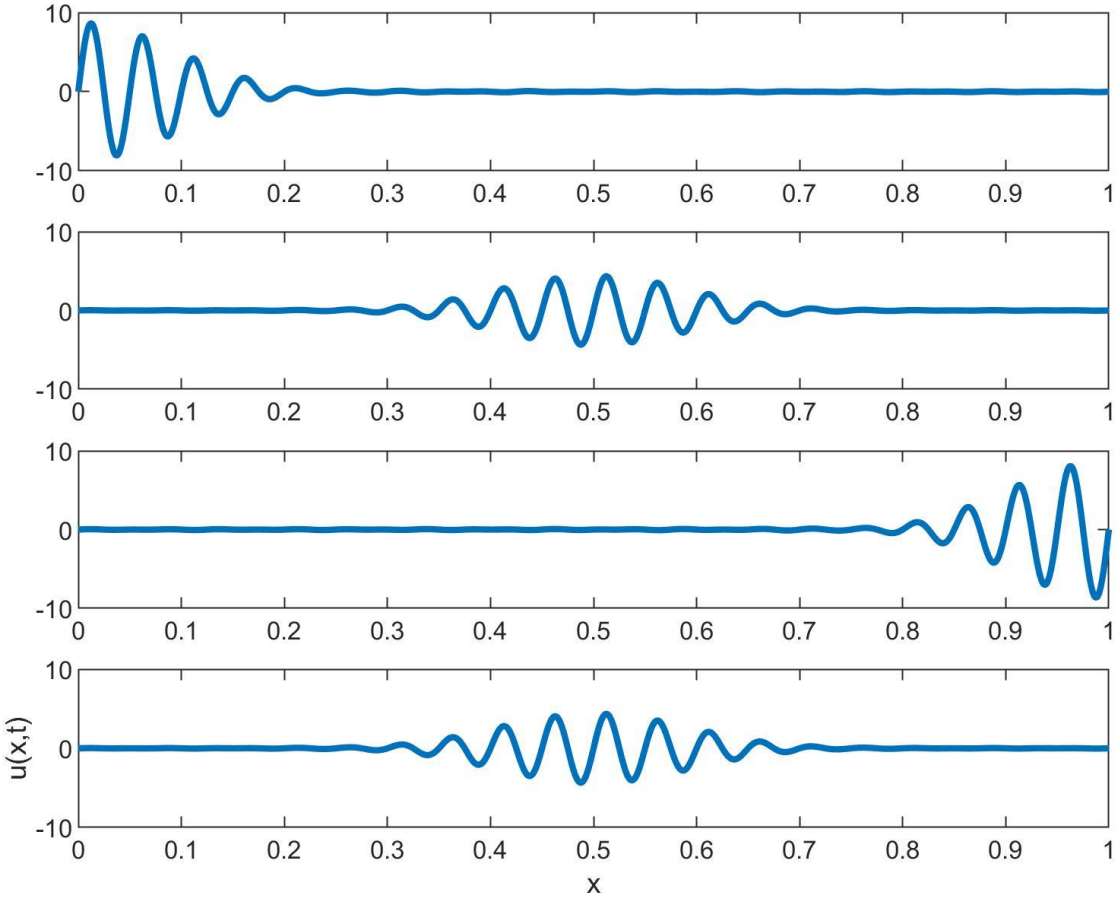
$$a_n = 2\int_0^1 P(x)\sin(n\pi x)\,dx$$

Plot for (a)



Plot for (b)

Top to bottom: $t = 0, 0.5, 1, 1.5$



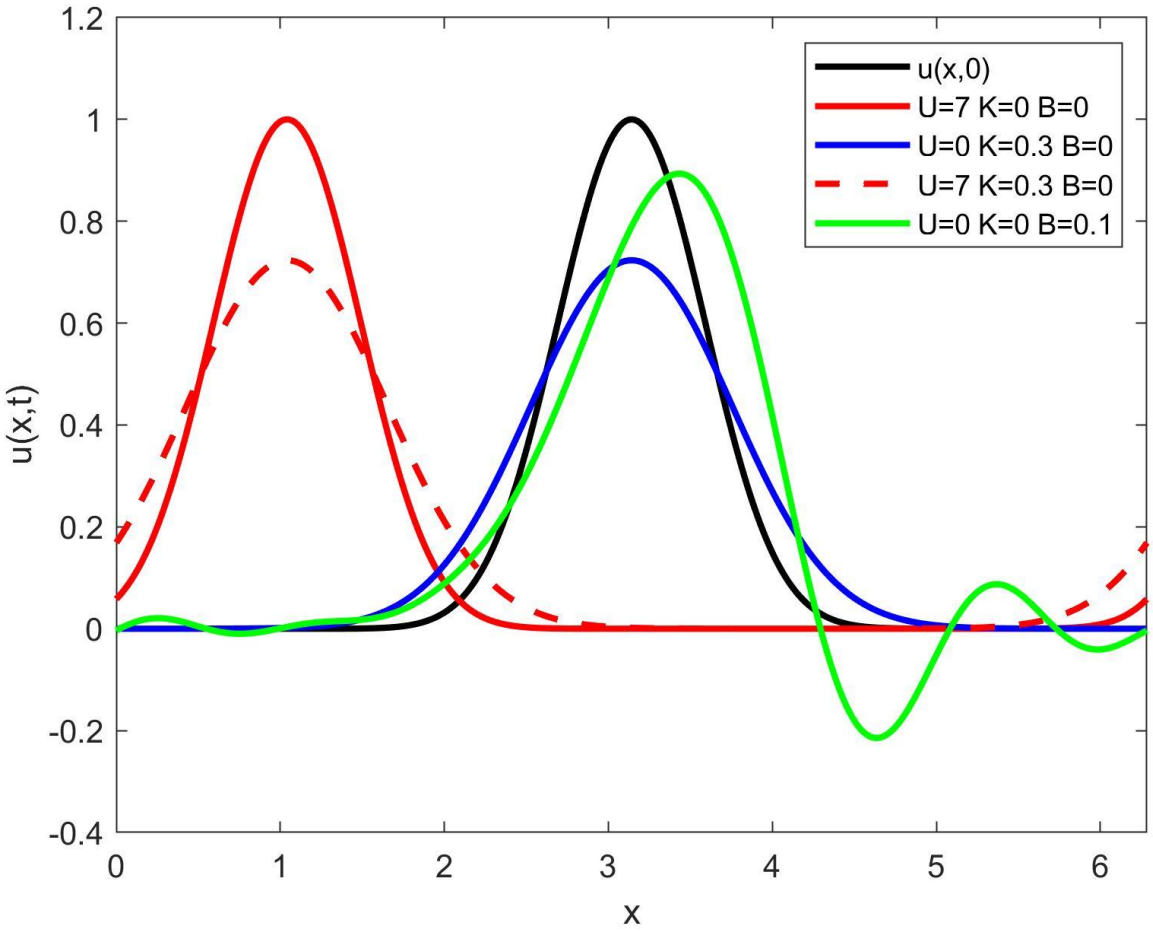
Problem 2

$$u(x,t) = \sum_{n=-\infty}^{\infty} C_n(0) e^{(inU - n^2K - in^3B)t + inx}$$

where

$$C_n(0) = \frac{1}{2\pi}\int_0^{2\pi} u(x,0) e^{-inx} dx$$

Plot:



Problem 3

$$u(x,t) = e^t + \sin\left(x - \frac{3t^2}{2}\right) + e^{-3t}\cos(2x)$$

Problem 4

$$u(x,t) = \sinh(t) + \cos(x) + t\sin(x)$$

Problem 5

$$u(x,t) = \cos(x) + \frac{1}{4}(e^{3t} - e^{-t})\sin(2x)$$