1. Text, 5.2

2. Text, 5.3

In part c), only answer the question about whether the scheme satisfies the CFL condition.

In part d), you should derive a scheme that **does** satisfy the CFL condition.

Now apply both schemes to the wave equation $u_{tt} = u_{xx}$ for $0 \le x \le 1$ with initial conditions

$$\begin{aligned} u(x,0) &= \sin(\pi x) \\ u_t(x,0) &= 0 \end{aligned} \tag{1}$$

Solve for $0 \le t \le 2$ with $M = 60, 100, 600, 1000, 6000$ time steps and with $N = (9/20)M$ space unknowns and generate convergence plots. What orders of convergence do you observe? Can you think of a reason to pick one of these methods over the other?

3. Text, 5.6 a-d