3.1.6 Finger Exercise: Identifying initial conditions, state evolution, and timestep from an IVP discrete solution

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Finger Exercises 1 due Aug 3, 2023 05:00 IST Completed

Problem: Extract the initial condition, state evolution, and timestep

3/3 points (graded)

MO2.4 **MO2.7**

Consider an Initial Value Problem (IVP) solver that is described in the documentation below:

```
def solve(N):
    """
    Solves an IVP using a timestep dt and method.

    Input:
      N: number of timesteps (including initial state)

    Returns:
        t (float list): time values at which u(t) is approximated. The nth item in
            the list is the time of the nth step, tn = t[n].
        u (list of float lists): The values of the states at each step.  The nth
            item in the list is the values of the states at tn.  i.e. u(tn) = u[n]
            where u[n] is a float list.  So, if there are three equations being integrated,
then
            u[n][0], u[n][1], and u[n][2] are the values of the three states at time t=t[n]
    """

    # ##########################
    # ... some algorithm here …
    # ##########################

    return t, u
```

Supposed we call `t, u = solve(3)` and the result gives:

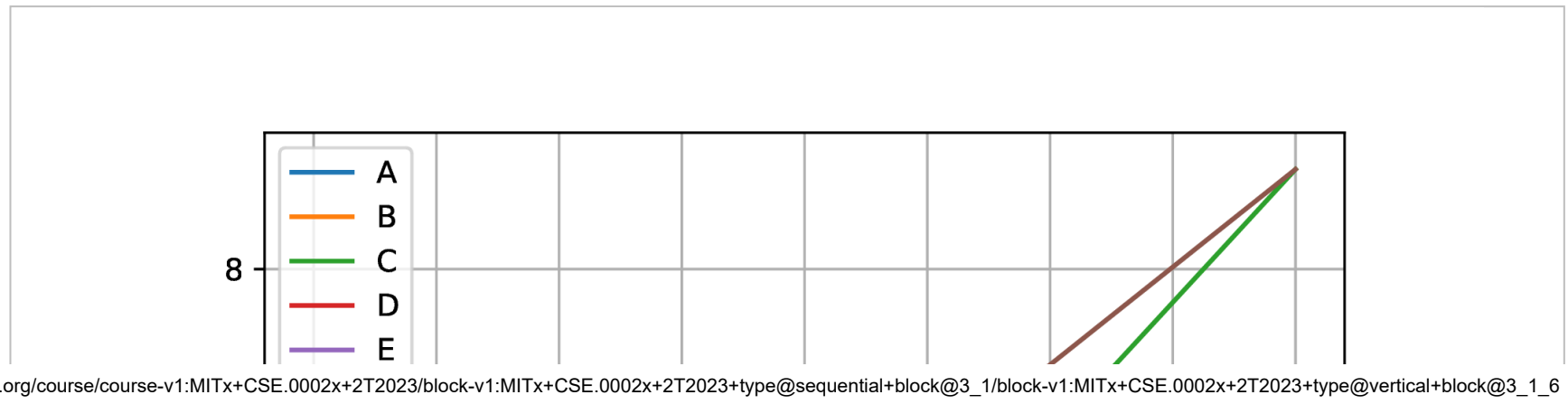
```
t= [0.0, 0.8, 1.6]
u= [[2.7, 3.1, 4.2], [1.2, 1.8, 4.5], [0.4, 2.8, 9.2]]
```

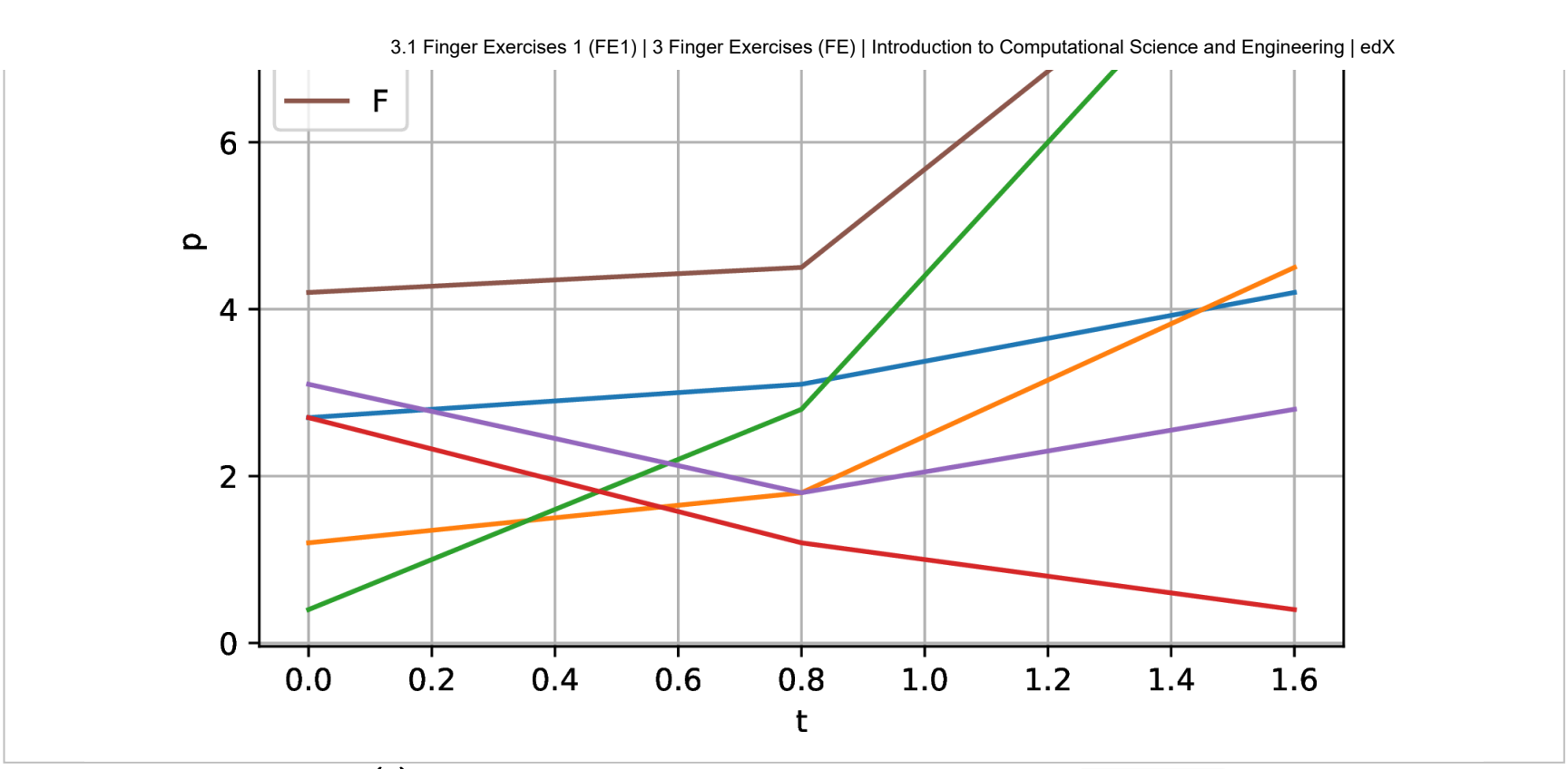
If $\underline{u} = [p, q, r]$, what were the initial conditions $p(0)$, $q(0)$, and $r(0)$ for this IVP?

- ○ $p(0) = 0.0$, $q(0) = 0.0$, and $r(0) = 0.0$
- ◉ $p(0) = 2.7$, $q(0) = 3.1$, and $r(0) = 4.2$
- ○ $p(0) = 2.7$, $q(0) = 1.2$, and $r(0) = 0.4$
- ○ Not enough information to answer

✔

Consider the figure below:





Which line is a plot of $p(t)$ using the results given above from calling `solve(3)`?

- A
- B
- C
- D
- E
- F
- Not enough information to answer

✔

What was the timestep Δt used by the solver? Enter -1 if there is not enough information to determine Δt.

0.8 ✔ Answer: 0.8

Submit

Answers are displayed within the problem

SOLUTION: The solution will be available shortly after the due date in Section 3.2.6.

‹ Previous Next ›