

```
import math
```

```
# Function to calculate the forward differences
```

```
def forward_difference(y_values):
```

```
    # Create a table for forward differences
```

```
    n = len(y_values)
```

```
    difference_table = [y_values]
```

```
    # Calculate forward differences
```

```
    for i in range(1, n):
```

```
        temp = []
```

```
        for j in range(n - i):
```

```
            temp.append(difference_table[i - 1][j + 1] - difference_table[i - 1][j])
```

```
        difference_table.append(temp)
```

```
    return difference_table
```

```
# Function to apply Newton's Forward Interpolation
```

```
def newton_forward_interpolation(x_values, y_values, t):
```

```
    # Calculate the forward differences table
```

```
    difference_table = forward_difference(y_values)
```

```
    # Calculate the value of  $u = (t - x_0) / h$  where  $h$  is the difference between  $x$  values
```

```
    h = x_values[1] - x_values[0] # Assuming the  $x$  values are equally spaced
```

```
    u = (t - x_values[0]) / h
```

```
# Initialize the interpolated value
interpolated_value = y_values[0]

# Apply the Newton's Forward Formula
u_term = u
for i in range(1, len(x_values)):
    # Factorial term is divided by i! and added to the interpolated value
    interpolated_value += (u_term * difference_table[i][0]) / math.factorial(i)
    # Update u_term for the next iteration
    u_term *= (u - i)

return interpolated_value
```

```
# Main function
```

```
def main():
```

```
    # Given data points (time and voltage across the capacitor)
```

```
    x_values = [0, 1, 2, 3, 4, 5] # Time in seconds
```

```
    y_values = [0, 2.5, 4.5, 5.5, 5.8, 6.0] # Voltage across capacitor in volts
```

```
    # Input the time at which we need to estimate the voltage
```

```
    t = float(input("Enter the time (t) to estimate the voltage (in seconds): "))
```

```
    # Apply Newton's Forward Interpolation to estimate the voltage
```

```
    estimated_voltage = newton_forward_interpolation(x_values, y_values, t)
```

```
    # Output the result
```

```
print(f"The estimated voltage across the capacitor at {t} seconds is: {estimated_voltage}")
```

```
# Run the main function
```

```
if __name__ == "__main__":
```

```
    main()
```