Exercise 35

The unemployment rate $U(t)$ varies with time. The table gives the percentage of unemployed in the US labor force from 2003 to 2012.

(a) What is the meaning of $U'(t)$? What are its units?

(b) Construct a table of estimated values for $U'(t)$.

t	$U(t)$	t	$U(t)$
2003	6.0	2008	5.8
2004	5.5	2009	9.3
2005	5.1	2010	9.6
2006	4.6	2011	8.9
2007	4.6	2012	8.1

Source: US Bureau of Labor Statistics

Solution

$U'(t)$ is the rate at which the percentage of unemployed people is increasing with respect to time (units of %/year). To obtain the values of $U'(t)$, calculate the slope of the secant line going through two adjacent t values. At $t = 2003$, for example,

$$U'(t) = \frac{U(2004) - U(2003)}{2004 - 2003} = \frac{5.5 - 6.0}{1} = -0.50.$$

At $t = 2004$, there are two secant lines.

$$U'(t) = \frac{U(2004) - U(2003)}{2004 - 2003} = \frac{5.5 - 6.0}{1} = -0.50$$

$$U'(t) = \frac{U(2005) - U(2004)}{2005 - 2004} = \frac{5.1 - 5.5}{1} = -0.40$$

At such times where there are two possible secant lines, take the average for the best estimate.

$$\frac{(-0.5) + (-0.4)}{2} = -0.45$$

t	$U(t)$	$U'(t)$
2003	6.0	−0.50
2004	5.5	−0.45
2005	5.1	−0.45
2006	4.6	−0.25
2007	4.6	0.60
2008	5.8	2.35
2009	9.3	1.90
2010	9.6	−0.20
2011	8.9	−0.75
2012	8.1	−0.80