

TOPIC 11: LEARNING CURVES

Solutions to Practice Problems

$$\begin{aligned}
 1. \text{ Case 1: } b &= \log_{10}(.78) / \log_{10}(2) \\
 &= (-.1079 / .3010) \\
 &= -.358
 \end{aligned}$$

$$\begin{aligned}
 C_{50} &= C_1(50^b) \\
 &= 800(50^{-.358}) \\
 &= 800(.2465) \\
 &= \mathbf{\$197.20}
 \end{aligned}$$

$$\begin{aligned}
 2. \text{ Case 2: } b &= \log_{10}(175/200) / \log_{10}(10) \\
 &= (-.0580 / 1) \\
 &= -.058
 \end{aligned}$$

$$\begin{aligned}
 C_{70} &= C_1(70^b) \\
 &= 200(70^{-.058}) \\
 &= 200(.7816) \\
 &= \mathbf{\$156.32}
 \end{aligned}$$

$$\begin{aligned}
 3. \text{ Case 3: } b &= \log_{10}(C_n / C_m) / \log_{10}(n/m) \\
 &= \log_{10}(19/24) / \log_{10}(20/4) \\
 &= (-.1015 / .6990) \\
 &= -.145
 \end{aligned}$$

$$\begin{aligned}
 r &= 2^b \\
 &= 2^{-.145} \\
 &= \mathbf{90.4\%}
 \end{aligned}$$

4. From the table:

$$\text{Total hours for 275 units} = 13.4216(60) = 805.3$$

$$\text{Total hours for 80 units} = 8.8140(60) = 528.8$$

$$\text{Time for demand in second year (81}^{\text{st}} \text{ through 275}^{\text{th}} \text{ units)} = 805.3 - 528.8 = \mathbf{276.5}$$

5. a. $b = \log_{10}(r) / \log_{10}(2) = \log_{10}(.70) / \log_{10}(2) = -.1549 / .3010 = -.515$ (or use the b -values table in your handout).

$$C_n = C_1(n)^b \Rightarrow C_4 = 60(4)^{-.515} = \mathbf{29.4 \text{ minutes}}$$

b. Using the “Table of Cumulative Values for Learning Curves,” we have:

$$\text{Total time} = 60(2.7582) = \mathbf{165.5 \text{ minutes}}$$

6. a. The learning rate r is calculated as follows:
 $b = \log_{10}(C_n / C_1) / \log_{10}(n) = \log_{10}(45 / 50) / \log_{10}(2) = -.0458 / .3010 = -.152$
 $r = 2^b = 2^{-.152} = .90$
- b. The time the worker should take to do the 20th assembly is:
 $C_n = C_1(n)^b \Rightarrow C_{20} = 50(20)^{-.152} = \mathbf{31.71 \text{ minutes}}$
7. $b = \log_{10}(C_n / C_1) / \log_{10}(n) = \log_{10}(41 / 100) / \log_{10}(16) = -.3216$
 $r = 2^b = 2^{-.3216} = \mathbf{.80}$
8. $b = \log_{10}(r) / \log_{10}(2) = \log_{10}(.80) / \log_{10}(2) = -.0969 / .3010 = -.322$ (or use the b -values table in your handout)
 $C_n = C_1(n)^b \Rightarrow C_4 = 100(4)^{-.322} = \mathbf{64 \text{ hours}}$

9. There are two ways to solve the problem.

Method 1.

$$b = \log_{10}(C_n / C_m) / \log_{10}(n / m) = \log_{10}(50 / 70) / \log_{10}(10 / 5) = -.4854$$

$$r = 2^b = 2^{-.4854} = \mathbf{71.4\%}$$

Method 2.

Since the worker doubles his or her production when producing the 10th unit (compared to the 5th unit), the learning rate r can be calculated using the following shortcut:

$$r = C_{10} / C_5 = 50 / 70 = \mathbf{71.4\%}$$

10. a. $b = \log_{10}(r) / \log_{10}(2) = \log_{10}(.60) / \log_{10}(2) = -.22185 / .30103 = -.7370$ (or use the b -values table in your handout).
 $C_n = C_1(n)^b \Rightarrow C_{15} = 20 * (15)^{-.7370} = \mathbf{2.72 \text{ minutes}}$

- b. Using the “Table of Cumulative Values for Learning Curves,” we have:

$$\text{Total time to finish the homework} = 20(4.574) = 91.48 \text{ minutes.}$$

Therefore, it will be approximately 7:31 p.m. when Joe finishes the homework. Thus, his girlfriend will ignore him for the rest of the night.