Solutions Manual

# Module E: Learning Curves

1. 

Cognitive Domain: Knowledge

Difficulty Level: Easy

2a. 

2b. From Table E.2 for *n* = 5 and learning rate of 90%, the coefficient value is 4.339. 

Cognitive Domain: Knowledge

Difficulty Level: Easy

3. 

Cognitive Domain: Knowledge

Difficulty Level: Easy

4a. From Table E.2 for *n* = 5 and learning rate of 85%, the coefficient value is 4.031. 

4b. 

Cognitive Domain: Knowledge

Difficulty Level: Easy

5. 

Cognitive Domain: Application

Difficulty Level: Medium

6. From Table E.2 for *n* = 5 and learning rate of 80%, the coefficient value is 3.738. 

Cognitive Domain: Knowledge

Difficulty Level: Easy

7. 



Cognitive Domain: Application

Difficulty Level: Medium

8. 

From Table E.2 for *n* = 20 and learning rate of 75%, the coefficient value is 8.828. 

Cognitive Domain: Application

Difficulty Level: Medium

9a. Based on the times for Unit 1 and Unit 2, we can derive the following:

Alternatively, simply dividing 43/50 = 0.86.

Other doublings in the data set are Unit 2 and Unit 4 (37/43 = .86) and Unit 3 and Unit 6 (34/39 = .87).

Averaging these three results yields a learning curve estimate of 0.864.

9b. The Table E.2 multiplier for LC = .86, *n* = 20 is 12.819.

on average for 20 returns

Cognitive Domain: Analysis

Difficulty Level: Medium

10a. From Unit 1 to Unit 2, the learning rate is 45/55 = 0.818; from Unit 2 to Unit 4, the learning rate is 37/45 = 0.822. It appears the learning rate is closer to 82%.

10b. The Table E.2 multiplier for LC = .82, *n* = 30 is 15.185.



Cognitive Domain: Analysis

Difficulty Level: Medium

11a. 

11b. The Table E.2 multiplier for LC = .75, *n* = 15 is 7.319.



11c. The Table E.2 multiplier for LC = .75, *n* = 20 is 8.828.

; for Units 16 through 20: 723.89 – 600.16 = 123.73hrs x $40 = $4,949.

Cognitive Domain: Analysis

Difficulty Level: Medium

12.



|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Worker* | *1st Unit* | *2nd Unit* | *LC* | *ln(12)/T1* | *ln(LC)/ln(2)* | *ex* | *n* |
| Jordan | 20 | 18 | 18/20 = .90 | -.511 | -.152 | 3.361 | 29 |
| Pippen | 22 | 19 | 19/22 = .86 | -.606 | -.211 | 2.865 | 17 |
| Johnson | 24 | 20 | 20/24 = .83 | -.693 | -.263 | 2.635 | 14 |

Cognitive Domain: Analysis

Difficulty Level: Medium

13. LC = 75/90 = .833



Cognitive Domain: Analysis

Difficulty Level: Medium

14.



The learning rate is 55.6%.

Cognitive Domain: Analysis

Difficulty Level: Medium

15a. Prince has 15 x 2,200 = 33,000 labor hours total available, so the sum of Units 1 through *n* cannot exceed that number. Using Table E.2 with LC = 80%, divide 33,000 by the T1 value of 8,000 to get 4.125. Look for this number in Table E.2 to determine that *n* = 5 is 3.738 and *n* = 6 is 4.299. Prince can complete five planes and almost finish a sixth.

15b. Using the same method, at a 75% learning rate Prince can complete almost seven airplanes.

Cognitive Domain: Analysis

Difficulty Level: Medium

16a. The Table E.2 multiplier for LC = .75, *n* = 15 is 7.319.



16b.



Cognitive Domain: Analysis

Difficulty Level: Medium

17a. The Table E.2 multiplier for LC = .70, *n* = 35 is 10.133.



17b. The average time per pair is 607.98/35 = 17.371.

17c. Number of workers needed = 608/160 = 3.79 (round up to 4).

Cognitive Domain: Analysis

Difficulty Level: Medium

18a. 

18b. The Table E.2 multiplier for LC = .75, *n* = 15 is 7.319.



The Table E.2 multiplier for LC = .75, *n* = 9 is 5.204.



Units 10 through 15 require 58.552 – 41.632 = 16.92.

18c. $45 x 58.552 = $2,634.84

Cognitive Domain: Analysis

Difficulty Level: Medium

19.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Trainee* | *1st Unit* | *2nd Unit* | *LC* | *5th Unit* | *Reassigned* |
| Theresa | 11 | 9 | .82 |  | Yes |
| Eric | 10 | 9 | 0.9 |  | Yes |
| Nicole | 12 | 9 | 0.75 |  | Yes |

Cognitive Domain: Analysis

Difficulty Level: Medium

20a. The Table E.2 multiplier for LC = .70, *n* = 25 is 8.404.



Total labor cost = $30 x 504.24 = $15,127.2

Direct material cost = $15 x 25 = $375

Setup cost = $40

Labor, material, and setup cost = $15,127.2 + 375 + 40 = $15,542.2

Overhead charge = 0.6 x $15,542.2 = $9,325.32

Total cost = $15,542.2 + 9,325.32 = $24,867.5

Unit cost = $24,867.5/25 = $994.7.

20b. A breakeven amount is unlikely if they continue to sell goggles for $200 per unit. At 25 units, their overall per-unit cost is just under $1,000. For the 25th pair of goggles, they have 11.45 hours of labor at a cost of $344. Discounting the setup cost, they would need to have $200 – $15(1.6) = $176 in labor and overhead charges, which is 3.14 hours to assemble at $35 per hour with the 60% overhead charge. They could achieve this figure at Unit 308 but then would have to continue to produce to make up for the significant loss on the first 307 units.

Cognitive Domain: Analysis

Difficulty Level: Medium