

Linear Algebra and its Applications with R: Solution Set

Ruriko Yoshida

Chapter 1

Section 1.2

Section 1.2.5

- Quiz 1: False
- Quiz 2: False
- Quiz 3: False
- Quiz 4: False
- Quiz 5: True
- Quiz 6: False
- Quiz 7: True
- Quiz 8: False
- Quiz 9: False
- Quiz 10: False
- Quiz 11: True
- Quiz 12: False
- Quiz 13: (ii)
- Quiz 14: (iv)
- Quiz 15: (iv)
- Quiz 16: (ii)
- Quiz 17: (iii)
- Quiz 18: (i)
- Quiz 19: (i)

Section 1.2.6

Exercise 1.6:

1. 3
2. 4
- 3.

$$\begin{bmatrix} 5 & 16 & 3 & 16 \end{bmatrix} \begin{bmatrix} 6 & 19 & 9 & 5 \end{bmatrix} \begin{bmatrix} 10 & 17 & 19 & 13 \end{bmatrix}$$

4.

$$\begin{bmatrix} 5 \\ 6 \\ 10 \end{bmatrix}, \begin{bmatrix} 16 \\ 19 \\ 17 \end{bmatrix}, \begin{bmatrix} 3 \\ 9 \\ 19 \end{bmatrix}, \begin{bmatrix} 16 \\ 5 \\ 13 \end{bmatrix}.$$

Section 1.3

Section 1.3.5

Quiz 20: True

Quiz 21: False

Quiz 22: True

Quiz 23: False

Quiz 24: False

Quiz 25: True

Section 1.3.6

Exercise 1.15:

1. Yes
2. Unique
3. $x_1 = 6, x_2 = 1/2$.

Exercise 1.17:

1. Yes
2. Unique
3. $x_1 = 0.6969697, x_2 = -2.7575758$.

Exercise 1.19:

1. No
2. No solution
3. NA

Exercise 1.21:

1. Yes
2. Unique
3. $x_1 = 0.8469945, x_2 = -0.1475410, x_3 = 7.0546448$.

Exercise 1.23:

1. Yes

2. Unique

3. $x_1 = -1.0986079, x_2 = 0.1392111, x_3 = -0.8016241$.

Exercise 1.25:

1. Yes

2. Unique

3. $x_1 = 2.657895, x_2 = 2.052632, x_3 = -2.710526$.

Exercise 1.27:

1. $n \neq 1$.

2. $x_1 = 8/(h-1), x_2 = \frac{5h+3}{2(h-1)}$.

Exercise 1.31: Solve the system of equations such that

$$\begin{array}{rcl} x_1 & + & x_2 = 2200 \\ 1.5x_1 & + & 4x_2 = 5050. \end{array}$$

The solution is $x_1 = 1500, x_2 = 700$. The number of children is 1500 and the number of adults is 700.

Exercise 1.31: Let d be the distance and t be the time running. So we have

$$\begin{array}{rcl} d & = & 0.2t \\ d & = & 0.5(t - 8.5). \end{array}$$

So we have the system of linear equations such that

$$\begin{array}{rcl} d - 0.2t & = & 0 \\ d - 0.5t & = & -4.25. \end{array}$$

The solution is $d = 17/6, t = 85/6$. So 17/6km.

Exercise 1.31: Let x_1 be the number of chocolate cupcakes, x_2 be the number of strawberry cupcakes, and x_3 be the number of lemon cupcakes. We have the system of linear equations such that

$$\begin{array}{rcl} x_1 & + & x_2 & + & x_3 & = & 24 \\ 0.6x_1 & + & 0.4x_2 & + & 0.3x_3 & = & 61/5 \\ x_1 & - & 2x_2 & - & 2x_3 & = & 0. \end{array}$$

The solution is $x_1 = 16, x_2 = 2, x_3 = 6$.

Section 1.4

Section 1.4.5

Quiz 27: False

Quiz 28: False

Quiz 29: True

Quiz 30: False

Quiz 31: True

Quiz 32: True

Quiz 33: False

Quiz 34: False

Quiz 35: False

Quiz 36: 2

Quiz 37: 1

Quiz 38: 3

Quiz 39: 3

Quiz 40: 2

Quiz 41: 1

Section 1.4.6

Exercise 1.38: The system of linear equations

$$\begin{aligned}x_1 - 6x_2 &= 3 \\ -x_1 + 2x_2 &= -1.\end{aligned}$$

has the reduced echelon form:

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -0.5 \end{bmatrix}.$$

So we have a solution $x_1 = 0, x_2 = -0.5$.

Exercise 1.40: The system of linear equations

$$\begin{aligned}-5x_1 + 5x_2 - x_3 &= 57 \\ -7x_1 - 2x_2 - 4x_3 &= 21 \\ x_1 + 3x_2 + 4x_3 &= 3\end{aligned}$$

has the reduced echelon form:

$$\begin{bmatrix} 1 & 0 & 0 & -2.697479 \\ 0 & 1 & 0 & 7.815126 \\ 0 & 0 & 1 & -4.436975 \end{bmatrix}.$$

So we have a solution $x_1 = -2.697479, x_2 = 7.815126, x_3 = -4.436975$.

Exercise 1.43: The system of linear equations

$$\begin{aligned}5x_1 + 10x_2 - 5x_3 &= -5 \\ -10x_2 + 3x_3 &= -5 \\ 10x_1 + 6x_2 - 9x_3 &= -1\end{aligned}$$

has the reduced echelon form:

$$\begin{bmatrix} 1 & 0 & 0 & -4 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & -5 \end{bmatrix}.$$

So we have a solution $x_1 = -4, x_2 = -1, x_3 = -5$.

Chapter 2

Section 2.2

Section 2.2.5

- Quiz 42: False
- Quiz 43: True
- Quiz 44: True
- Quiz 45: False
- Quiz 46: False
- Quiz 47: True
- Quiz 48: False
- Quiz 49: True
- Quiz 50: True
- Quiz 51: True
- Quiz 52: False
- Quiz 53: True
- Quiz 54: False
- Quiz 55: False
- Quiz 56: 2
- Quiz 57: 3
- Quiz 58: 3
- Quiz 59: 2
- Quiz 60: 1

Section 2.2.6

Exercise 2.2: We can set up the system of linear equations such that

$$\begin{array}{rcl} a & + & b & & = & 3 \\ -a & - & 2b & & = & -5 \\ & & & c & = & 2 \\ & & & c & + & d & = & 4. \end{array}$$

So we have the solution $a = 1, b = 2, c = 2, d = 2$.

Exercise 2.2:

1.

$$\begin{bmatrix} -15 & -24 & -31 \\ -5 & -27 & 34 \end{bmatrix}.$$

2.

$$\begin{bmatrix} -15 & -24 & -31 \\ -5 & -27 & 34 \end{bmatrix}.$$

3.

$$\begin{bmatrix} -1 & -5 & 21 \\ 10 & 50 & -10 \\ -19 & 19 & 46 \end{bmatrix}.$$

4.
$$\begin{bmatrix} -5 & -29 & 10 \\ 17 & 62 & 16 \\ -19 & -19 & 38 \end{bmatrix}.$$

5.
$$\begin{bmatrix} -5 & -37 & 9 \\ 24 & -30 & 20 \end{bmatrix}.$$

6.
$$\begin{bmatrix} -5 & 24 \\ -37 & -30 \\ 9 & 20 \end{bmatrix}.$$

7. Correction: $C \cdot B^T + -A^T$

$$\begin{bmatrix} -15 & 14 \\ 5 & -32 \\ 9 & -6 \end{bmatrix}.$$

8. Correction: $(3 \cdot C + D) + (2 \cdot E - F) \cdot F^T$

$$\begin{bmatrix} -77 & -19 & 25 \\ -6 & 4 & -12 \\ 70 & 11 & -48 \end{bmatrix}.$$

9. Correction: $-A^T \cdot B \cdot (C - 2 \cdot D) - (2 \cdot C + D) + ((-1) \cdot E + 2 \cdot F) \cdot F^T$

$$\begin{bmatrix} 143 & 90 & 89 \\ -111 & -224 & -367 \\ -39 & 40 & 52 \end{bmatrix}.$$

10.
$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}.$$

Exercise 2.6:

$$A = \begin{bmatrix} 5 & 1 & 10 & 6 \\ -1 & -7 & -6 & 5 \\ -7 & 4 & -1 & 1 \\ -5 & 3 & -4 & -8 \end{bmatrix}.$$

$$x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}.$$

$$b = \begin{bmatrix} 2 \\ 38 \\ 24 \\ -18 \end{bmatrix}.$$

Exercise 2.8:

$$A = \begin{bmatrix} 8 & 6 & -4 & -3 \\ -5 & 8 & 1 & 6 \\ 6 & 5 & 4 & -1 \\ -5 & 10 & 8 & -1 \end{bmatrix}.$$

$$x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}.$$

$$b = \begin{bmatrix} -75 \\ -7 \\ -20 \\ -3 \end{bmatrix}.$$

Section 2.3

Section 2.3.5

- Quiz 61: True
- Quiz 62: True
- Quiz 63: False
- Quiz 64: True
- Quiz 65: False
- Quiz 66: True
- Quiz 67: True
- Quiz 68: False
- Quiz 69: True
- Quiz 70: True
- Quiz 71: False
- Quiz 72: True
- Quiz 73: False
- Quiz 74: False
- Quiz 75: False
- Quiz 76: True
- Quiz 77: True
- Quiz 78: True

Section 2.3.6

Exercise 2.18:

$$A^{-1} = \begin{bmatrix} 1/3 & 0 \\ 1/3 & 1/3 \end{bmatrix}.$$

Exercise 2.20:

$$A^{-1} = \begin{bmatrix} 0.21739130 & -0.1739130 \\ 0.08695652 & 0.1304348 \end{bmatrix}.$$

Exercise 2.23:

$$A^{-1} = \begin{bmatrix} 1/a_{11} & 0 & \cdots & 0 & 0 \\ 0 & 1/a_{22} & \cdots & 0 & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \cdots & 1/a_{n-1n-1} & 0 \\ 0 & 0 & \cdots & 0 & 1/a_{nn} \end{bmatrix},$$

Section 2.4

Section 2.4.5

- Quiz 79: True
- Quiz 80: True
- Quiz 81: True
- Quiz 82: True
- Quiz 83: True
- Quiz 84: True
- Quiz 85: True

Section 2.4.6

Exercise 2.38: It will add -3 the second row of A and the fourth row of the matrix A .

Exercise 2.40:

1.

$$E = \begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix},$$

2.

$$E = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix},$$

Exercise 2.42: No.

Chapter 3

Section 3.3

Section 3.3.2

Quiz 86: True

Quiz 87: False

Quiz 88: False

Quiz 89: True

Quiz 90: False

Quiz 91: False

Quiz 92: False

Quiz 93: True

Section 3.3.3

Exercise 3.1: -39

Exercise 3.3: 3

Exercise 3.5: 184

Exercise 3.7: -32

Exercise 3.9: 39

Exercise 3.11: -3

Exercise 3.13: -184

Exercise 3.15: 32

Exercise 3.20:

1. $-(a \cdot d - b \cdot c)$

2. $k \cdot (a \cdot d - b \cdot c)$

3. $(a \cdot d - b \cdot c)$

4. $(a \cdot d - b \cdot c)$

Exercise 3.20: $k^2 \cdot (a \cdot d - b \cdot c)$

Section 3.4

Section 3.4.5

- Quiz 94: True
- Quiz 95: False
- Quiz 96: False
- Quiz 97: True
- Quiz 98: False
- Quiz 99: True
- Quiz 100: True
- Quiz 101: True
- Quiz 102: True
- Quiz 103: True
- Quiz 104: True
- Quiz 105: 2
- Quiz 106: 2
- Quiz 107: 1
- Quiz 108: 2
- Quiz 109: 1
- Quiz 110: 3

Section 3.4.6

Exercise 3.37:

$$\begin{bmatrix} 1 & -2 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 9 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1/39 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 5 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix}$$

Exercise 3.39:

$$\begin{bmatrix} -1/3 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 9 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & -1/39 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1/2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \\ \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -2 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1/2 \\ 0 & 0 & 1 \end{bmatrix}$$

Exercise 3.43:

1. $2 \cdot (-2)$
2. 2^3
3. $2 \cdot 2$
4. $2 \cdot 2$
5. 2

Exercise 3.51: $k^n \cdot \det(A)$, where n is the rank of A .

Section 3.5

Section 3.5.5

Quiz 111: False

Quiz 112: True

Quiz 113: True

Quiz 114: True

Quiz 115: True

Chapter 4

Section 4.2

Section 4.2.5

Quiz 116: True
Quiz 117: True
Quiz 118: False
Quiz 119: True
Quiz 120: False
Quiz 121: True
Quiz 122: True
Quiz 123: True

Section 4.3

Section 4.3.5

Quiz 124: True
Quiz 125: False
Quiz 126: True
Quiz 127: False
Quiz 128: False
Quiz 129: True
Quiz 130: False
Quiz 131: False
Quiz 132: True
Quiz 133: False

Section 4.3.6: Errata

- Exercise 4.19: Exercise 1.38 instead of Exercise 3.1.
- Exercise 4.20: Exercise 1.39 instead of Exercise 3.2.
- Exercise 4.21: Exercise 1.40 instead of Exercise 3.3.
- Exercise 4.22: Exercise 1.41 instead of Exercise 3.4.
- Exercise 4.23: Exercise 1.42 instead of Exercise 3.5.
- Exercise 4.24: Exercise 1.43 instead of Exercise 3.6.
- Exercise 4.25: Exercise 1.44 instead of Exercise 3.7.
- Exercise 4.26: Exercise 1.45 instead of Exercise 3.8.
- Exercise 4.27: Exercise 1.46 instead of Exercise 3.9.
- Exercise 4.28: Exercise 1.47 instead of Exercise 3.10.

Section 4.3.6

Exercise 4.12:

1.

$$\left\{ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \right\}.$$

2.

$$\left\{ x_1 \cdot \begin{bmatrix} 0 \\ -3 \\ 2 \end{bmatrix} + x_2 \cdot \begin{bmatrix} 0 \\ -1 \\ 1 \end{bmatrix} + x_3 \cdot \begin{bmatrix} 3 \\ -2 \\ 3 \end{bmatrix} \mid x_1, x_2, x_3 \in \mathbb{R} \right\}.$$

3.

$$\{x_1 \cdot [0 \ 0 \ 3] + x_2 \cdot [-3 \ -1 \ -2] + x_3 \cdot [2 \ 1 \ 3] \mid x_1, x_2, x_3 \in \mathbb{R}\}.$$

Exercise 4.14:

1.

$$\{x_1 [0 \ 1 \ 0 \ 0] \mid x_1 \in \mathbb{R}\}.$$

2.

$$\left\{ x_1 \cdot \begin{bmatrix} -2 \\ 3 \\ 2 \end{bmatrix} + x_2 \cdot \begin{bmatrix} 0 \\ 1 \\ -2 \end{bmatrix} + x_3 \cdot \begin{bmatrix} 0 \\ 1 \\ -1 \end{bmatrix} \mid x_1, x_2, x_3 \in \mathbb{R} \right\}.$$

3.

$$\{x_1 \cdot [-2 \ 0 \ 0 \ 0] + x_2 \cdot [3 \ 0 \ 1 \ 1] + x_3 \cdot [2 \ 0 \ -2 \ -1] \mid x_1, x_2, x_3 \in \mathbb{R}\}.$$

Exercise 4.20: The null space is

$$\left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix} \right\}.$$

The solution is $x_1 = 0, x_2 = -1/2$.

Exercise 4.22: The null space is

$$\left\{ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \right\}.$$

The solution is $x_1 = -2.697479, x_2 = 7.815126, x_3 = -4.436975$.

Section 4.4

Section 4.4.5

- Quiz 134: False
- Quiz 135: True
- Quiz 136: True
- Quiz 137: False
- Quiz 138: False
- Quiz 139: True
- Quiz 140: True
- Quiz 141: True
- Quiz 142: False
- Quiz 143: False
- Quiz 144: False
- Quiz 145: False

Section 4.4.6

Exercise 4.30:

1.

$$\left\{ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \right\}.$$

2.

$$\left\{ \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}, \begin{bmatrix} 0 \\ -2 \\ -1 \end{bmatrix}, \begin{bmatrix} 3 \\ 2 \\ -2 \end{bmatrix} \right\}.$$

3.

$$\{ [1 \ 0 \ 3], [0 \ -2 \ 2], [-1 \ -1 \ -2] \}.$$

4. 3

5. 0

Exercise 4.32:

1.

$$\left\{ \begin{bmatrix} 0.1612810 \\ 0.6451240 \\ 0.3763223 \\ 0.6451240 \end{bmatrix} \right\}.$$

2.

$$\left\{ \begin{bmatrix} -3 \\ -1 \\ -3 \end{bmatrix}, \begin{bmatrix} -0 \\ 1 \\ -3 \end{bmatrix}, \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix} \right\}.$$

3.

$$\{[-3 \ 0 \ 3 \ -1], [-1 \ 1 \ -3 \ 1], [-3 \ -3 \ 3 \ 2]\}.$$

4. 3

5. 1

Exercise 4.36:

1.

$$\left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix} \right\}.$$

2.

$$\left\{ \begin{bmatrix} 1 \\ -1 \end{bmatrix}, \begin{bmatrix} 3 \\ -1 \end{bmatrix} \right\}.$$

3.

$$\{[1 \ -6], [-1 \ 2]\}.$$

4. 2

5. 0

Exercise 4.38:

1.

$$\left\{ \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \right\}.$$

2.

$$\left\{ \begin{bmatrix} 5 \\ 7 \\ -1 \end{bmatrix}, \begin{bmatrix} 5 \\ -2 \\ 3 \end{bmatrix}, \begin{bmatrix} -1 \\ -4 \\ 4 \end{bmatrix} \right\}.$$

3.

$$\{[-5 \ 5 \ -1], [7 \ 2 \ 4], [1 \ 3 \ 4]\}.$$

4. 3

5. 0

Chapter 5

Section 5.2

Section 5.2.5

Quiz 151: False
Quiz 152: False
Quiz 153: False
Quiz 154: False
Quiz 155: True
Quiz 156: False
Quiz 157: False
Quiz 158: True
Quiz 159: False
Quiz 160: False
Quiz 161: True
Quiz 162: False

Section 5.2.6

Exercise 5.2:

1. 3.316625
2. $\sqrt{3}$
3. 2.012461
4. 2.166667

Section 5.3

Section 5.3.5

Quiz 163: True
Quiz 164: False
Quiz 165: False
Quiz 166: True
Quiz 167: True
Quiz 168: True
Quiz 169: True
Quiz 170: False
Quiz 171: False
Quiz 172: False
Quiz 173: False
Quiz 174: True

Section 5.3.6Exercise 5.6: $\theta = 45^\circ$ Exercise 5.8: $\theta = \arccos 4/\sqrt{22}$

Exercise 5.12:

$$\begin{bmatrix} 1/2 \\ 1/2 \end{bmatrix}.$$

Exercise 5.14:

$$\begin{bmatrix} 4/11 \\ 4/11 \\ 12/11 \end{bmatrix}.$$

Exercise 5.16:

$$\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}.$$

Chapter 6

Section 6.2

Section 6.2.5

- Quiz 175: False
- Quiz 176: False
- Quiz 177: True
- Quiz 178: True
- Quiz 179: True
- Quiz 180: False
- Quiz 181: True
- Quiz 182: True
- Quiz 183: True
- Quiz 184: 1, 3, 4
- Quiz 185: False
- Quiz 186: True
- Quiz 187: 1, 3, 4
- Quiz 188: False
- Quiz 189: True

Section 6.2.6

Exercise 6.1:

1. Eigen values 2.7320508, -0.7320508 . Eigen vectors

$$\begin{bmatrix} 0.8660254 \\ 0.5000000 \end{bmatrix}, \begin{bmatrix} -0.8660254 \\ 0.5000000 \end{bmatrix}.$$

Yes.

2. Eigen values 5.464102, -1.464102 . Eigen vectors

$$\begin{bmatrix} 0.4209739 \\ 0.9070727 \end{bmatrix}, \begin{bmatrix} -0.4209739 \\ 0.9070727 \end{bmatrix}.$$

Yes.

3. Eigen values 4, 0. Eigen vectors

$$\begin{bmatrix} 0.4472136 \\ 0.8944272 \end{bmatrix}, \begin{bmatrix} -0.4472136 \\ 0.8944272 \end{bmatrix}.$$

No.

4. Eigen values 5, -1 . Eigen vectors

$$\begin{bmatrix} 0.4472136 \\ 0.8944272 \end{bmatrix}, \begin{bmatrix} -1 \\ 1 \end{bmatrix}.$$

Yes.

5. Eigen values 2.561553, -1.561553, 1. Eigen vectors

$$\begin{bmatrix} -0.8750489 \\ 0.4554783 \\ 0.1637954 \end{bmatrix}, \begin{bmatrix} 0.5644704 \\ -0.4819736 \\ 0.6701303 \end{bmatrix}, \begin{bmatrix} -7.071068e^{-01} \\ -1.440816e^{-16} \\ 7.071068e^{-01} \end{bmatrix}.$$

Yes.

Section 6.3

Section 6.3.5

- Quiz 190: True
- Quiz 191: False
- Quiz 192: True
- Quiz 193: True
- Quiz 194: True
- Quiz 195: True
- Quiz 196: False
- Quiz 197: False