Errata for Edition 1 of *Coding the Matrix*, October 7, 2013

- Definition 0.3.14: "there exists $x \in A$ such that $f(x) = z$" should be "there exists $x \in D$ such that $f(x) = z$."
- Section 1.4.1: "Using the fact that $\mathbf{i}^2 = 1$" should be "Using the fact that $\mathbf{i}^2 = -1$"
- Example 2.9.1: "Consider the dot-product of $[1, 1, 1, 1, 1]$ with $[10, 20, 0, 40, 100]$" should be "Consider the dot-product of $[1, 1, 1, 1, 1]$ with $[10, 20, 0, 40, -100]$."
- Example 2.9.5:

  $$cost = \text{Vec}(D, \{\text{hops} : \$2.50/ounce, \text{malt} : \$1.50/pound, \text{water} : \$0.006\}, \text{yeast} : \$0.45/gram)$$

  should be

  $$cost = \text{Vec}(D, \{\text{hops} : \$2.50/ounce, \text{malt} : \$1.50/pound, \text{water} : \$0.006, \text{yeast} : \$0.45/gram\})$$

- Definition 2.9.6: "A *linear equation* is an equation of the form $\boldsymbol{a}\cdot \ = \beta$, where ... is a vector variable." should be "A *linear equation* is an equation of the form $\boldsymbol{a} \cdot \boldsymbol{x} = \beta$, where ... $\boldsymbol{x}$ is a vector variable."
- Definition 2.9.10: "In general, a *system of linear equations* (often abbreviated *linear system*) is a collection of equations:

  $$\begin{aligned} \boldsymbol{a}_1\cdot &= \beta_1 \\ \boldsymbol{a}_2\cdot &= \beta_2 \\ &\vdots \\ \boldsymbol{a}_m\cdot &= \beta_m \end{aligned}$$

  where is a vector variable. A *solution* is a vector $\hat{}$ that satisfies all the equations."

  should be

  "In general, a *system of linear equations* (often abbreviated *linear system*) is a collection of equations:

  $$\begin{aligned} \boldsymbol{a}_1 \cdot \boldsymbol{x} &= \beta_1 \\ \boldsymbol{a}_2 \cdot \boldsymbol{x} &= \beta_2 \\ &\vdots \\ \boldsymbol{a}_m \cdot \boldsymbol{x} &= \beta_m \end{aligned}$$

  where $\boldsymbol{x}$ is a vector variable. A *solution* is a vector $\hat{\boldsymbol{x}}$ that satisfies all the equations."
- Example 2.9.17:
  - "The password is $\hat{} = 10111$" should be "The password is $\hat{\boldsymbol{x}} = 10111$",
  - "Harry computes the dot-product $\boldsymbol{a}_1 \cdot \hat{}$" should be "Harry computes the dot-product $\boldsymbol{a}_1 \cdot \hat{\boldsymbol{x}}$"
  - "Harry computes the dot-product $\boldsymbol{a}_2 \cdot \hat{}$" should be "Harry computes the dot-product $\boldsymbol{a}_2 \cdot \hat{\boldsymbol{x}}$"
  - "Carole lets Harry log in if $\beta_1 = \boldsymbol{a}_1 \cdot \hat{}, \beta_2 = \boldsymbol{a}_2 \cdot \hat{}, \ldots, \beta_k = \boldsymbol{a}_k \cdot \hat{}$." should be "Carole lets Harry log in if $\beta_1 = \boldsymbol{a}_1 \cdot \hat{\boldsymbol{x}}, \beta_2 = \boldsymbol{a}_2 \cdot \hat{\boldsymbol{x}}, \ldots, \beta_k = \boldsymbol{a}_k \cdot \hat{\boldsymbol{x}}$."
- Example 2.9.28: "Eve can use the distributive property to compute the dot-product of this sum with the password even though she does not know the password:

  $$\begin{aligned} (01011 + 11110)\cdot &= 01011\cdot + 11110\cdot \\ &= 0 + 1 \\ &= 1 \end{aligned}$$

”

should be

“Eve can use the distributive property to compute the dot-product of this sum with the password $\boldsymbol{x}$ even though she does not know the password:

$$\begin{array}{rcccc} (01011 + 11110) \cdot \boldsymbol{x} & = & 01011 \cdot \boldsymbol{x} & + & 11110 \cdot \boldsymbol{x} \\ & = & 0 & + & 1 \\ & = & & 1 & \end{array}$$

”

- Quiz 3.1.7: the solution

```
def lin_comb(vlist,clist):
  return sum([coeff*v for (c,v) in zip(clist, vlist)])
```

should be

```
def lin_comb(vlist,clist):
  return sum([coeff*v for (coeff,v) in zip(clist, vlist)])
```

- In Example 3.2.7, “The secret password is a vector ˆ over $GF(2)$.... the human must respond with the dot-product $\boldsymbol{a} \cdot \hat{}$.” should be “The secret password is a vector $\hat{\boldsymbol{x}}$ over $GF(2)$... the human must respond with the dot-product $\boldsymbol{a} \cdot \hat{\boldsymbol{x}}$.”
- Section 4.11.2: “and here is the same diagram with the walk 3 c 2 e 4 2 shown” should be “and here is the same diagram with the walk 3 c 2 e 4 e 2 shown”
- Section 4.7.2: “Applying Lemma 4.7.4 with $\boldsymbol{v} = \boldsymbol{u}_1$ and $\boldsymbol{z} = \boldsymbol{u}_1 - \boldsymbol{u}_2$” should be “Applying Lemma 4.7.4 with $\boldsymbol{v} = \boldsymbol{u}_2$ and $\boldsymbol{z} = \boldsymbol{u}_1 - \boldsymbol{u}_2$”
- Section 4.7.4: “because it is the same as $H * \boldsymbol{c}$, which she can compute” should be “because it is the same as $H * \tilde{\boldsymbol{c}}$, which she can compute”
- Problem 4.17.10 is the same as Problem 4.17.5.
- Section 5.3.1: The Grow algorithm should be:

> def GROW($\mathcal{V}$)
> $B = \emptyset$
> repeat while possible:
> find a vector $\boldsymbol{v}$ in $\mathcal{V}$ that is not in Span B, and put it in B.

- Section 5.9.1:

```
L = [[0,0,0],[1,0,0],[0,1,0],[1,1,0],[0,0,1],[1,0,1],[0,1,1],[1,1,1]]]
```

should be

```
L = [[0,0,0],[1,0,0],[0,1,0],[1,1,0],[0,0,1],[1,0,1],[0,1,1],[1,1,1]]
```

- Section 5.12.6: The vector $\begin{bmatrix} x_1 \\ xvec_2 \\ 1 \end{bmatrix}$ should be $\begin{bmatrix} x_1 \\ x_2 \\ 1 \end{bmatrix}$
- Lemma 6.2.13 (Superset-Basis Lemma) states

For any vector space $\mathcal{V}$ and any linearly independent set A of vectors, $\mathcal{V}$ has a basis that contains all of A.

but should state

For any vector space $\mathcal{V}$ and any linearly independent set A of vectors belonging to $\mathcal{V}$, $\mathcal{V}$ has a basis that contains all of A.

- Task 7.8.9: "`gcd`(a, b)" should be "`gcd`$(a - b, N)$".
- Section 9.2: In new spec for `project_orthogonal(b, vlist)`, output should be "the projection $\boldsymbol{b}^{\perp}$ of $\boldsymbol{b}$ orthogonal to the vectors in *vlist*"
- Proof of Lemma 11.3.6: "Let $\mathcal{V}^*$ be the space dual to $\mathcal{V}$" should be "Let $\mathcal{V}^*$ be the annihilator of $\mathcal{V}$", and "the dual of the dual" should be "the annihilator of the annihilator".
- Section 11.3.3: "...we provide a module `svd` with a procedure `factor(A)` that, given a Mat `A`, returns a triple `(U, Sigma, V)` such that `A = U * Sigma * V.transpose`" should end "such that `A = U * Sigma * V.transpose()`"
- Task 11.6.6, "To help you debug, applying the procedure to with" should be "To help you debug, applying the procedure with"
- Section 11.4.1: The procedure `SVD_solve`(A) should take the vector $\boldsymbol{b}$ as a second argument: `SVD_solve`(A, b).
- Problem 12.14.8: Error in statement of Lemma 12.14. The eigenvalue of A having smallest asolute value is the *reciprocal* of the eigenvalue of A^{-1} having largest absolute value.
- Section 12.8.4: "Once consecutive addresses have been requested in timesteps t and $t+1$, it is very likely that the address requested in timestep $t+1$ is also consecutive" should end "that the address requested in timestep $t+2$ is also consecutive."