Chapter 1

EXERCISE ANSWERS

Exam Preparation Exercises

1. The steps keep repeating forever because there is no way for the algorithm to stop. (Also, it is a poor algorithm because the last action is lathering—you wouldn’t want to leave the lather in your hair.)

Corrected algorithm:

(1) Wet hair.
(2) Lather.
(3) Rinse.
(4) Repeat steps 2 and 3 once.

3. Recipe for pound cake:

- Preheat the oven to 350 degrees
- Line the bottom of a 9-inch tube pan with wax paper
- Sift 2¾ c flour, ¾ t cream of tartar, ½ t baking soda, 1½ t salt, and 1¾ c sugar into a large bowl
- Add 1 c shortening to the bowl
- If [BRANCH] using butter, margarine, or lard, then add 2/3 c milk to the bowl,
  else (for other shortenings) add 1 c minus 2 T of milk to the bowl
- Add 1 t vanilla to the mixture in the bowl
- If [BRANCH] mixing with a spoon, then [SUBALGORITHM REFERENCE] see the instructions in the introduction to the chapter on cakes,
  else (for electric mixers) beat the contents of the bowl for 2 minutes at medium speed, scraping the bowl and beaters as needed
- Add 3 eggs plus 1 extra egg yolk to the bowl
- Melt 3 squares of unsweetened chocolate and add to the mixture in the bowl
- Beat the mixture for 1 minute at medium speed
- Pour the batter into the tube pan
- Put the pan into the oven and bake for 1 hour and 10 minutes
  [SUBALGORITHM REFERENCE] Perform the test for doneness described in the introduction to the chapter on cakes
  [LOOP] Repeat the test once each minute until the cake is done
- Remove the pan from the oven and allow the cake to cool for 2 hours
  [SUBALGORITHM REFERENCE] Follow the instructions for removing the cake from the pan, given in the introduction to the chapter on cakes
- Sprinkle powdered sugar over the cracks on top of the cake just before serving

5. Hardware: disk drive, memory, arithmetic/logic unit, mouse, and CPU
   Software: compiler, editor, operating system, and object program

6. a. For means–ends analysis, you must know
   1) the starting state.
   2) the ending state.
   3) the actions available to get from start to end.
   b. The techniques can be combined by using divide–and–conquer to break up the actions into
smaller, simpler steps.

7. One approach to finding a job, using the divide–and–conquer strategy, would be as follows:

**Find a job**
- Find information on available jobs
  - Check newspaper.
  - Call employment service.
- **Apply for jobs**
  - Write résumé.
  - Submit résumé to potential employers.
  - Arrange interviews.
  - Attend interviews.
  - Make follow–up calls after promising interviews.

Each of these steps could be further subdivided.

**Programming Warm–Up Exercises**

1. **Algorithm to drive to airport:**

   From home, travel to I–10 interchange
   Get on I–10 eastbound
   If traffic heavy,
   - Get on north loop
   - Drive to Exit 23
   - Turn right on River Road
   - Drive to airport entrance
   - Turn left at airport entrance
   else
   - Drive to Exit 18
   - Turn left on River Road
   - Drive to airport entrance
   - Turn right at airport entrance
   Search lot for parking space

2. **Algorithm to make a peanut butter and jelly sandwich:**

   Open refrigerator door by pulling on door handle
   Remove bread bag, jelly jar and peanut butter jar from refrigerator
   Place bread bag, jelly jar and peanut butter jar on counter
   Close refrigerator door
   Open bread bag by removing twist–tie
   Remove 2 bread slices from bread bag
   Place 2 bread slices on counter
   Close bread bag using twist–tie
   Open jelly jar by unscrewing lid
   Place jelly jar lid on counter
   Open drawer under counter
   Remove knife from drawer
   Close drawer
   Use knife blade to scoop desired amount of jelly out of jar
   Spread jelly on face–up side of one slice of bread
   Close jelly jar by screwing lid on
   Open peanut butter jar by unscrewing lid
   Place peanut butter jar lid on counter
   Use knife blade to scoop out desired amount of peanut butter
   Spread peanut butter on face–up side of other slice of bread
   Close peanut butter jar by screwing lid on
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Place face–up sides of bread slices together so that their edges align
Open refrigerator door by pulling on door handle
Place bread bag, jelly jar, and peanut butter jar in refrigerator
Close refrigerator door

3. Sequential statements:

   Get On …
   Drive to . . .
   Turn . . .

Conditional statement:

   If traffic heavy . . . else . . .

Repetitive statement:

   Search lot . . .

   (This assumes there may be some difficulty finding a parking spot, hence the circling or looping.)

Subprogram statement:

   From home, travel to . . .

   (This step refers to all the instructions required to reach the I–10 interchange.)

Case Study Follow–Up

2. To follow an algorithm by hand, write the named quantities on a piece of paper, leaving space beside them. Perform each step of the algorithm in the order indicated. When the algorithm reads or calculates a value, write it next to the appropriate name. (You may wish to cross out old values when they are replaced.) Your worksheet will start like this:

   Employee number:  327  201
   Hourly pay rate:  8.30  6.60
   Hours worked:  48  40
   Wages:  431.60  264.00

3. The ends of the analysis are the input data and the employee’s wages for the week. We start with the hours worked and the pay rate for the employee. We end with the week’s pay for the employee.