Just Enough Programming Logic and Design, 1st Edition

Chapter 2

Exercises

1. In Figure 2-11 the process of buying and planting flowers in the spring was shown using the same structures as the generic example in Figure 2-10. Describe some other process with which you are familiar using exactly the same logic.

Answer:

Student answers will vary widely. They should come up with processes that fit the generic logic shown in Figure 2-10. Some examples could include: bringing making a dentist appointment or registering for a class. Pseudocode for each follows.

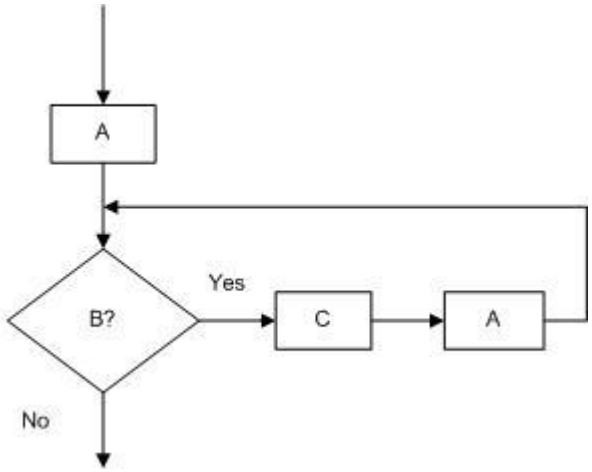
```
if it's time for your annual teeth cleaning
   call the dentist for an appointment tomorrow
   while the day and time you want isn't available
         if another time the same day is available
               make the appointment at the new time on the same day
         else
               pick a new day and time
         endif
   endwhile
   write appointment on your calendar
endif

if you are taking a class this semester then
   register for a class
   while the class is full
         if another section is available
               enroll for the available section
         else
               select a new class
         endif
   endwhile
   print schedule
endif
```

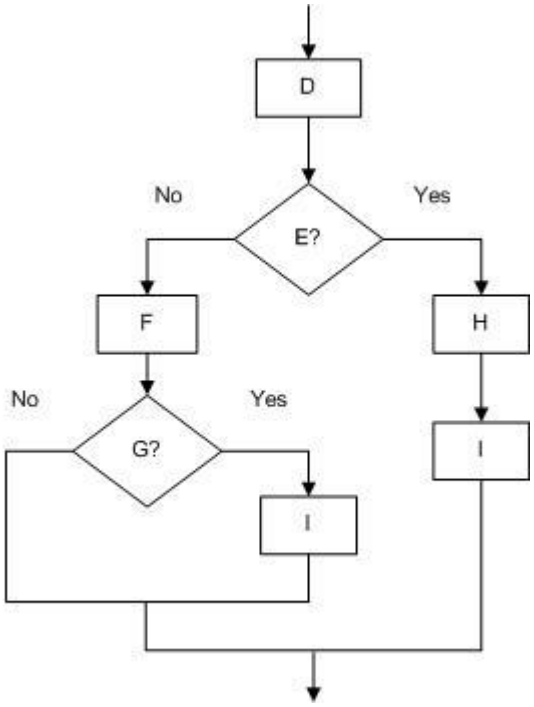
2. Each of the flowchart segments in Figure 2-35 is unstructured. Redraw each flowchart segment so that it does the same thing but is structured.

Answer:

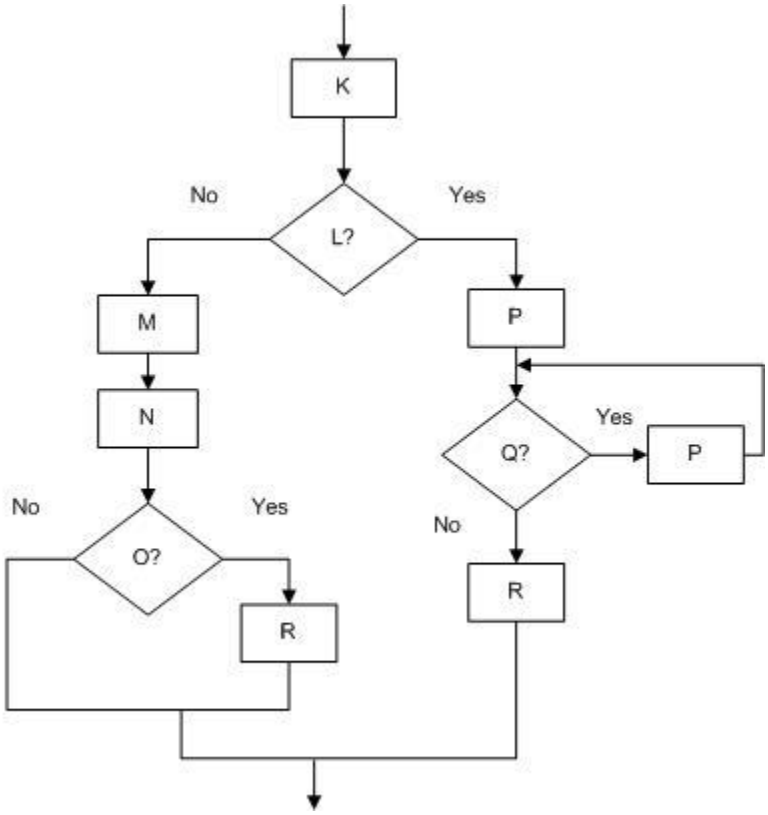
a.



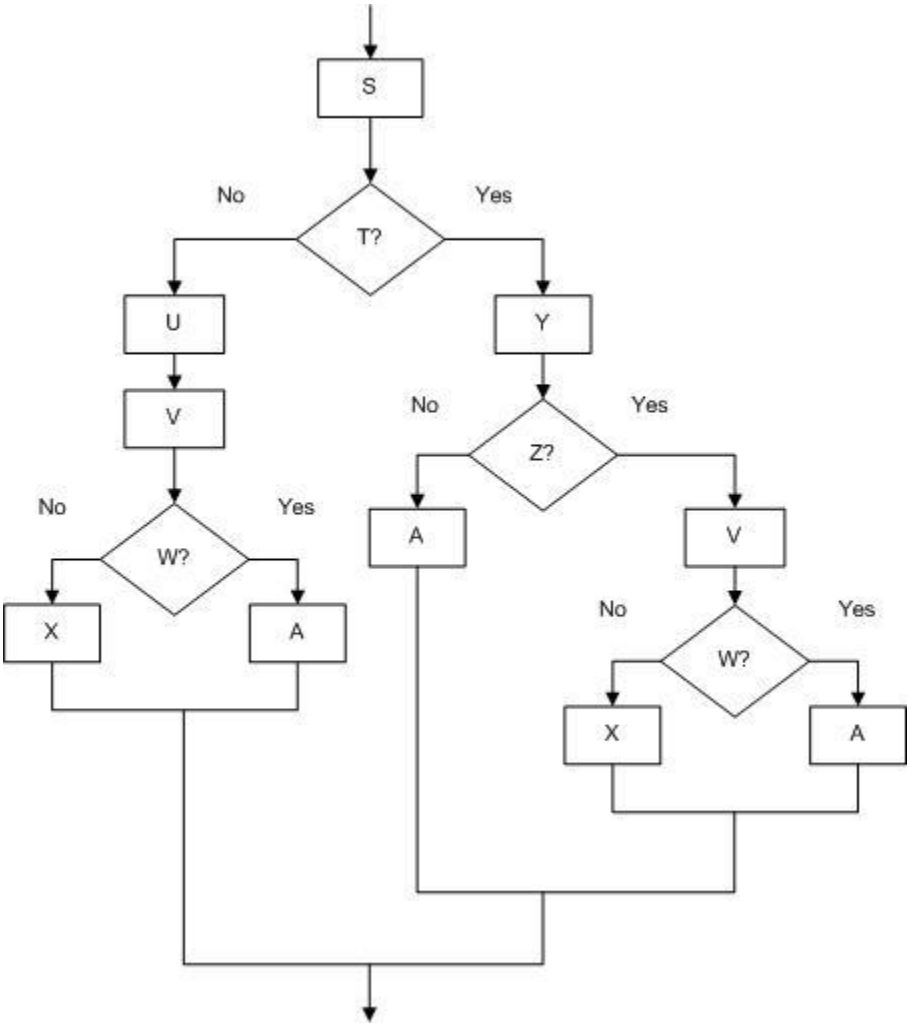
b.



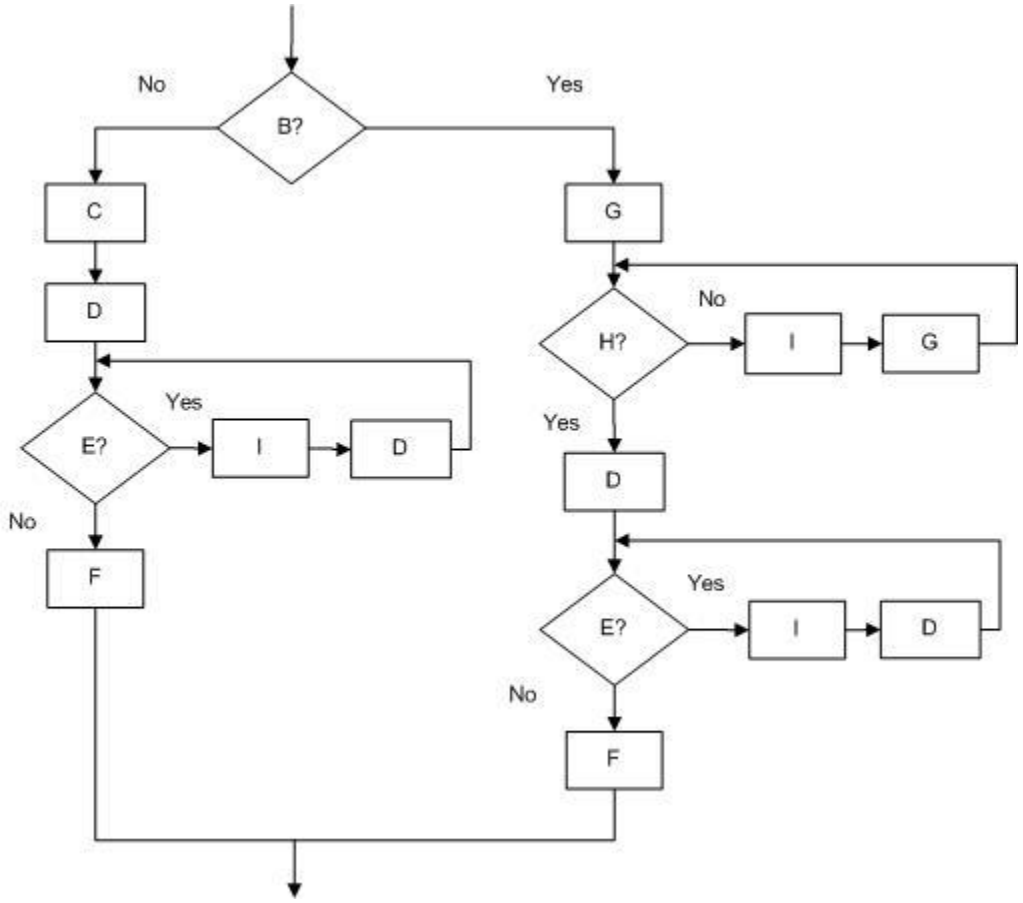
c.



d.



e.



3. Write pseudocode for each example (a through e) in Exercise 2 making sure your pseudocode is structured but accomplishes the same tasks as the flowchart segment.

Answer:

a.
```
do A
while B is true
      do C
       do A
endwhile
```

b.
```
do D
if E is true then
      do H
      do I
else
      do F
      if G is true then
            do I
      endif
endif
```

c.
```
do k
if L is true then
      do P
      while Q is true
            do P
      endwhile
      do R
else
      do M
      do N
      if O is true then
            do R
      endif
endif
```

d.
```
do S
if T is true then
      do Y
      if Z is true then
            do V
            if W is true then
                  do A
            else
                  do X
            endif
      else
            do A
      endif
else
      do U
      do V
      if W is true then
            do A
      else
            do X
      endif
endif
```

e.
```
if B is true then
      do G
      while H is not true
            do I
            do G
      endwhile
      do D
      while E is true
            do I
            do D
      endwhile
      do F
else
      do C
      do D
      while E is true
            do I
            do D
      endwhile
      do F
endif
```

4. Assume you have created a mechanical arm that can hold a pen. The arm can perform the following tasks:

   - Lower the pen to a piece of paper.
   - Raise the pen from the paper.
   - Move the pen one inch along a straight line. (If the pen is lowered, this action draws a one-inch line from left to right; if the pen is raised, this action just repositions the pen one inch to the right.)
   - Turn 90 degrees to the right.
   - Draw a circle that is one inch in diameter.

   Draw a structured flowchart or write structured pseudocode describing the logic that would cause the arm to draw the following:

   a. a one-inch square
   b. a two-inch by one-inch rectangle
   c. a string of three beads
   d. a short word (for example, “cat”).

   Have a fellow student act as the mechanical arm and carry out your instructions. Do not tell your mechanical arm partner what he or she will be drawing (or writing) before the partner attempts to carry out your instructions.

Answer:

This solution assumes the above tasks are labeled as follows:

A. Lower the pen to a piece of paper.
B. Raise the pen from the paper.

C. Move the pen one inch along a straight line. (If the pen is lowered, this action draws a one-inch line from the left to right; if the pen is raised, this action just repositions the pen one inch to the right.)
D. Turn 90 degrees to the right.
E. Draw a circle that is one inch in diameter.

a. a one-inch square

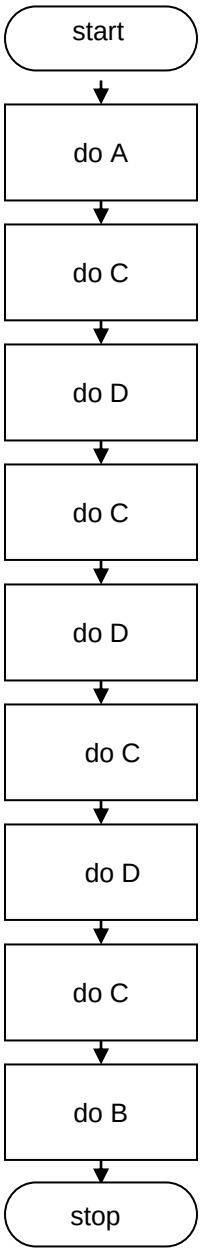
Pseudocode:

```
start
  lower the pen to a piece of paper
  move one inch along a straight line
  turn 90 degrees to the right
  move one inch along a straight line
  turn 90 degrees to the right
  move one inch along a straight line
  turn 90 degrees to the right
  move one inch along a straight line
  raise the pen from the paper
stop
```

or

```
start
  do A
  do C
  do D
  do C
  do D
  do C
  do D
  do C
  do B
stop
```

Flowchart:



b. a two-inch by one-inch rectangle

Pseudocode:

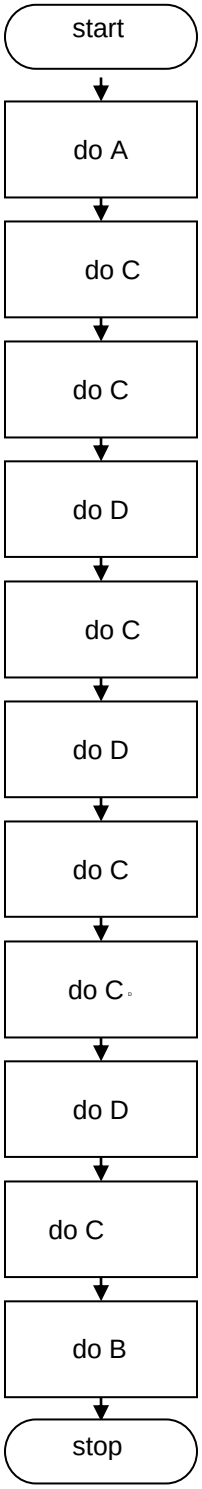
```
start
  lower the pen to a piece of paper
  move one inch along a straight line
  move one inch along a straight line
  turn 90 degrees to the right
  move one inch along a straight line
  turn 90 degrees to the right
  move one inch along a straight line
  move one inch along a straight line
  turn 90 degrees to the right
  move one inch along a straight line
  raise the pen from the paper
```

```
stop
```

or

```
start
  do A
  do C
  do C
  do D
  do C
  do D
  do C
  do C
  do D
  do C
  do B
stop
```

Flowchart:



c. a string of three beads

Pseudocode:

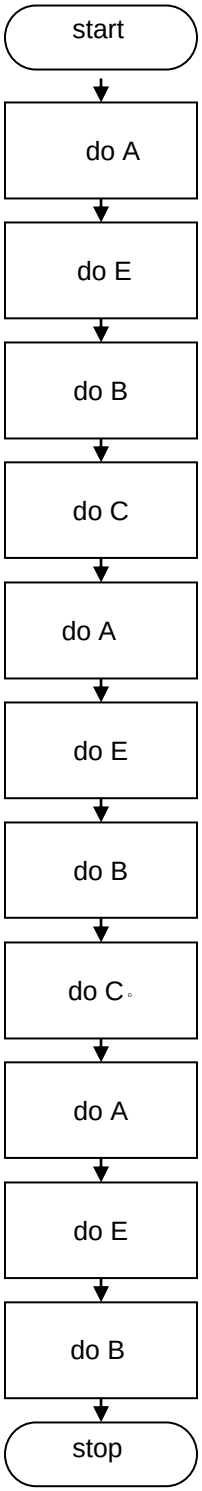
```
start
  lower the pen to a piece of paper
  draw a circle that is one-inch in diameter
  raise the pen from the paper
```

```
  move one inch along a straight line
  lower the pen to a piece of paper
  draw a circle that is one-inch in diameter
  raise the pen from the paper
  move one inch along a straight line
  lower the pen to a piece of paper
  draw a circle that is one-inch in diameter
  raise the pen from the paper
stop
```

or

```
start
  do A
  do E
  do B
  do C
  do A
  do E
  do B
  do C
  do A
  do E
  do B
stop
```

Flowchart:



d. a short word (for example, “cat”)

```
start
      lower the pen to a piece of paper
      move one inch along a straight line
```

```
        raise the pen from the paper
        turn 90 degrees right
        turn 90 degrees right
        move one inch along a straight line
        turn 90 degrees right
        lower the pen to a piece of paper
        move one inch along a straight line
        turn 90 degrees right
        move one inch along a straight line
        raise the pen from the paper
        move one inch along a straight line
        14.lower the pen to a piece of paper
        move one inch along a straight line
        turn 90 degrees right
        move one inch along a straight line
        turn 90 degrees right
        move one inch along a straight line
        turn 90 degrees right
        move one inch along a straight line
        move one inch along a straight line
        raise the pen from the paper
        turn 90 degrees right
        move one inch along a straight line
        turn 90 degrees right
        lower the pen to a piece of paper
        move one inch along a straight line
        turn 90 degrees right
        turn 90 degrees right
        turn 90 degrees right
        raise the pen from the paper
        move one inch along a straight line
        lower the pen to a piece of paper
        move one inch along a straight line
        move one inch along a straight line
        turn 90 degrees right
        turn 90 degrees right
        raise the pen from the paper
        move one inch along a straight line
        lower the pen to a piece of paper
        turn 90 degrees right
        move one inch along a straight line
        raise the pen from the paper
stop
```

or

```
start
      do A
      do C
      do B
      do D
      do D
      do C
      do D
      do A
      do C
```

```
            do D
            do C
            do B
            do C
            do A
            do C
            do D
            do C
            do D
            do C
            do D
            do C
            do C
            do B
            do D
            do C
            do D
            do A
            do C
            do D
            do D
            do D
            do B
            do C
            do A
            do C
            do C
            do D
            do D
            do B
            do C
            do A
            do D
            do C
            do B
stop
```

The flowchart will be very similar to parts a-c.

5. Assume you have created a mechanical robot that can perform the following tasks:
   - Stand up.
   - Sit down.
   - Turn left 90 degrees.
   - Turn right 90 degrees.
   - Take a step.

   Additionally, the robot can determine the answer to one test condition:
   - Am I touching something?

   Place two chairs 20 feet apart, directly facing each other. Draw a structured flowchart or write pseudocode describing the logic that would allow the robot to start from a sitting position in one chair, cross the room, and end up sitting in the other chair.

Have a fellow student act as the robot and carry out your instructions.

Answer:

This solution assumes the above tasks are labeled as follows:
A. Stand up.
B. Sit down.
C. Turn left 90 degrees.
D. Turn right 90 degrees.
E. Take a step.
F. Am I touching something?

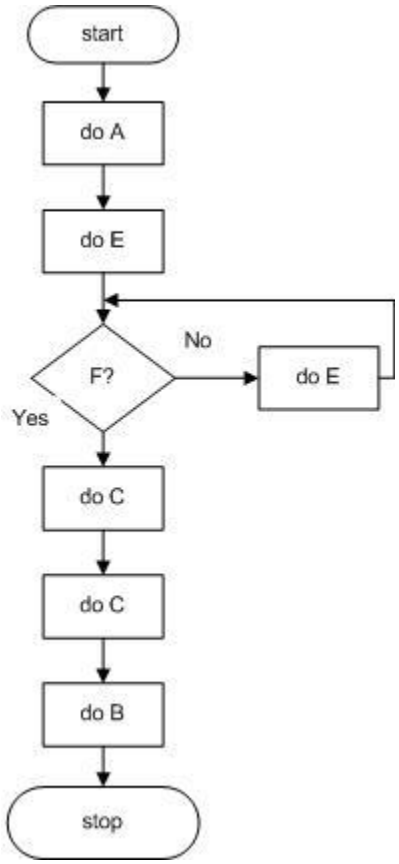
Pseudocode:

```
start
   stand up
   take a step
   while Am I touching something? is not true
       take a step
   endwhile
   turn left 90 degrees
   turn left 90 degrees
   sit down
stop
```

or

```
start
   do A
   do E
   while F is not true
       do E
   endwhile
   do C
   do C
   do B
stop
```

Flowchart:



6. Looking up a word in a dictionary can be a complicated process. For example, assume you want to look up "logic." You might proceed by opening the dictionary to a random page and see "juice." You know that word comes alphabetically before "logic," so you flip forward and see "lamb." That is still not far enough, so you flip forward and see "monkey." That means you have gone too far, so now you flip back, and so on. Draw a structured flowchart or write pseudocode that describes the process of looking up a word in a dictionary. Pick a word at random and have a fellow student attempt to carry out your instructions.

Answer:

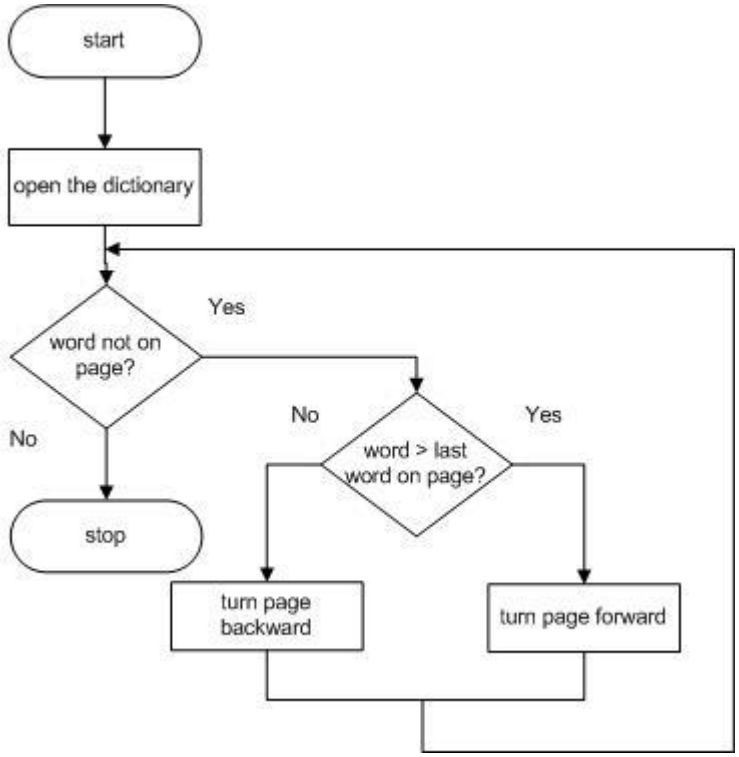
Answers will vary.

Pseudocode:

```
start
   open the dictionary
   while word not on page
         if word > last word on page
               turn the page forward
         else
               turn the page backward
```

```
        endif
   endwhile
stop
```

Flowchart:

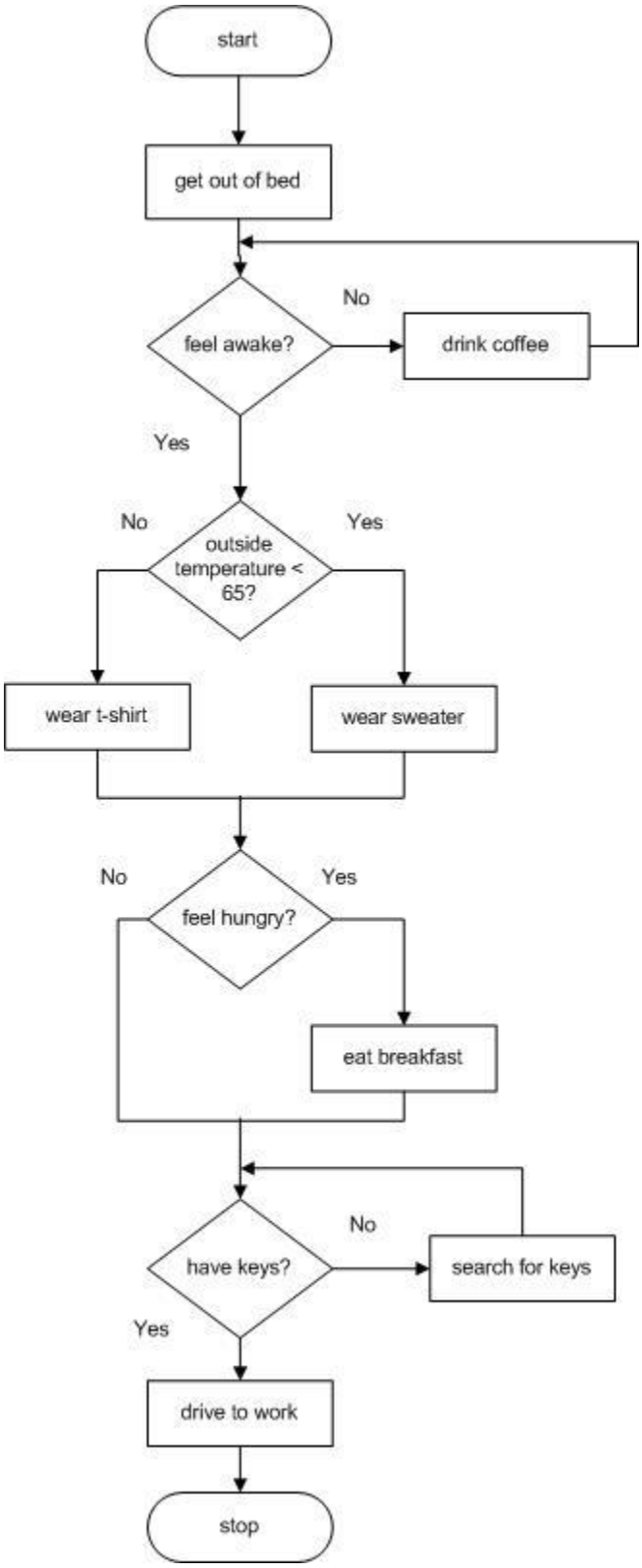


7. Draw a structured flowchart or write structured pseudocode describing your preparation to go to work or school in the morning. Include at least two decisions and two loops.

Answer:

Answers will vary. An example solution is shown below.

Flowchart:


start
get out of bed
feel awake?
No
drink coffee
Yes
No
outside temperature < 65?
Yes
wear t-shirt
wear sweater
No
feel hungry?
Yes
eat breakfast
have keys?
No
search for keys
Yes
drive to work
stop

Pseudocode:

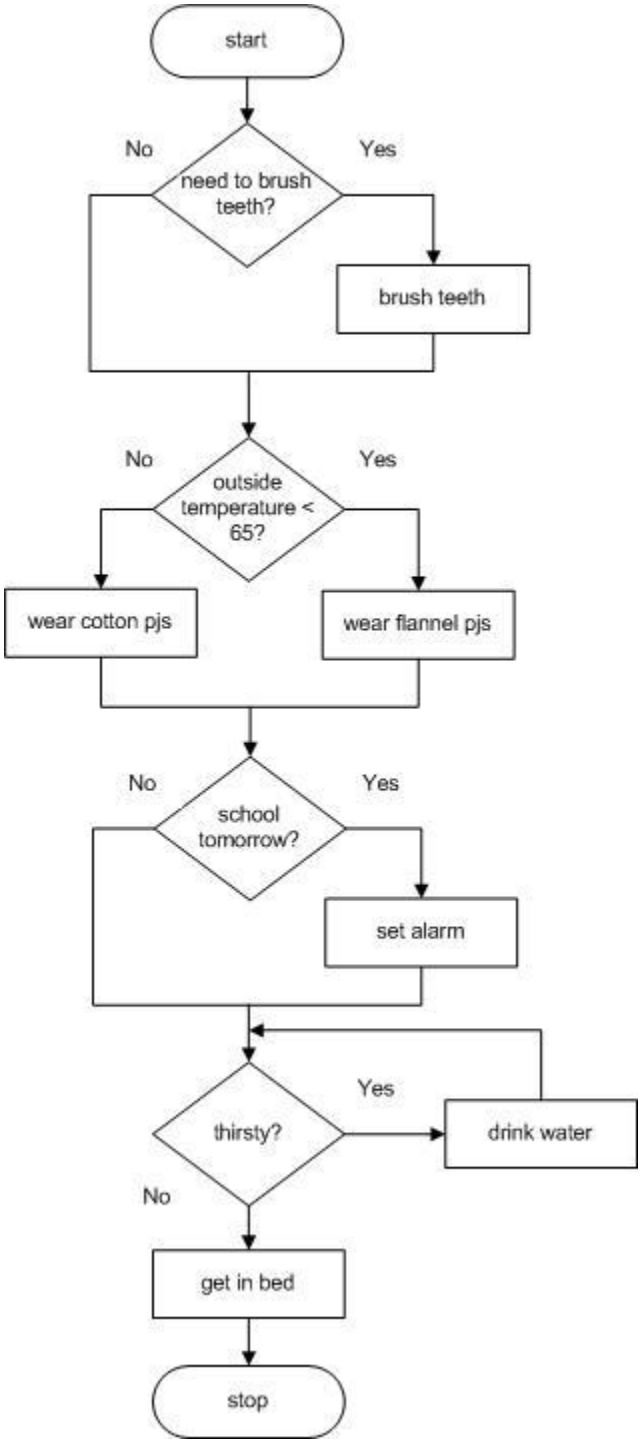
```
start
   get out of bed
   while feeling awake is not true
         drink coffee
   endwhile
   if the outside temperature < 65 is true then
         wear sweater
   else
         wear t-shirt
         endif
   if you're feeling hungry is true then
         eat breakfast
   endif
   while you have keys is not true
         search for keys
   endwhile
   drive to work
stop
```

8. Draw a structured flowchart or write structured pseudocode describing your preparation to go to bed at night. Include at least two decisions and two loops.

Answer:

Answers will vary. An example solution is shown below.

Flowchart:


start
No
need to brush teeth?
Yes
brush teeth
No
outside temperature < 65?
Yes
wear cotton pjs
wear flannel pjs
No
school tomorrow?
Yes
set alarm
Yes
thirsty?
drink water
No
get in bed
stop

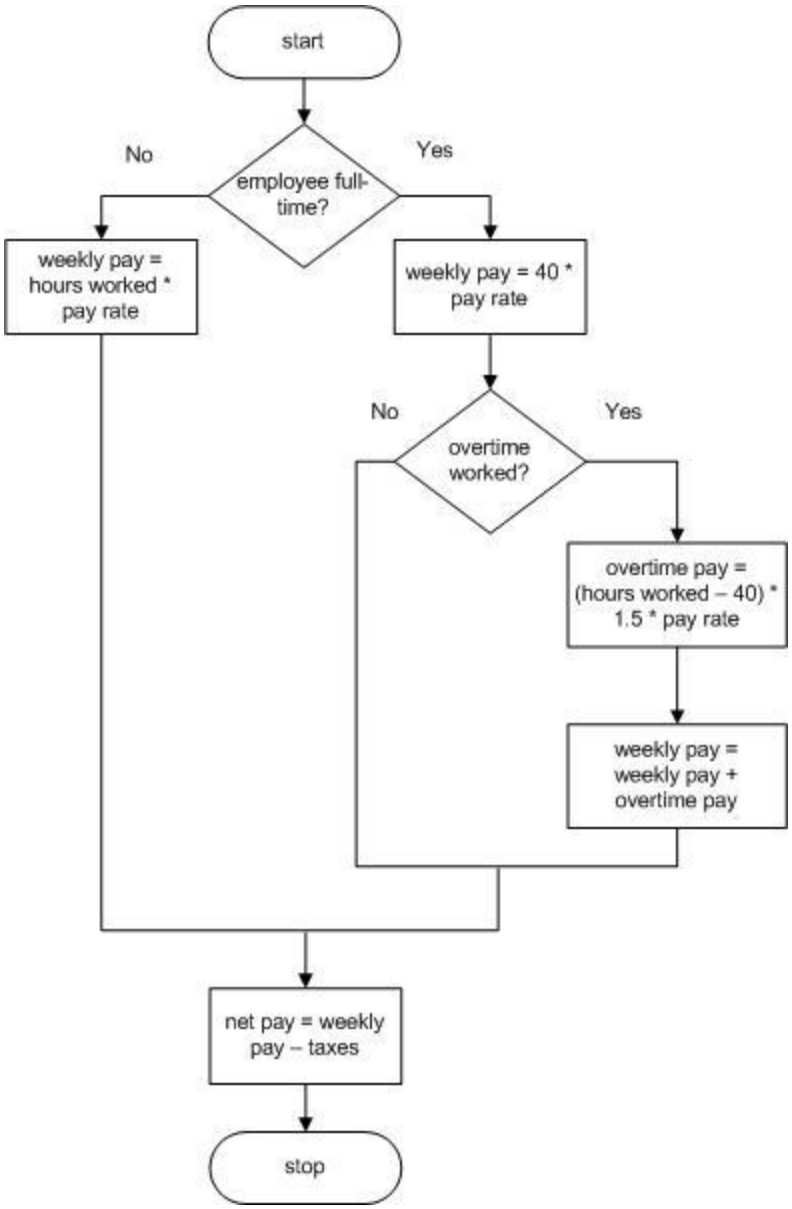
Pseudocode:

```
start
   if you need to brush your teeth then
         brush teeth
   endif
   if temperature is less than 65 degrees then
         wear flannel pajamas
   else
         wear cotton pajamas
   endif
   if tomorrow is a school day then
         set alarm clock
   endif
   while thirsty
         drink water
   endwhile
   get in bed
stop
```

9. Draw a structured flowchart or write structured pseudocode describing how your paycheck is calculated. Include at least two decisions.

Answer:

Answers will vary. An example solution is shown below.
Flowchart:



Pseudocode:

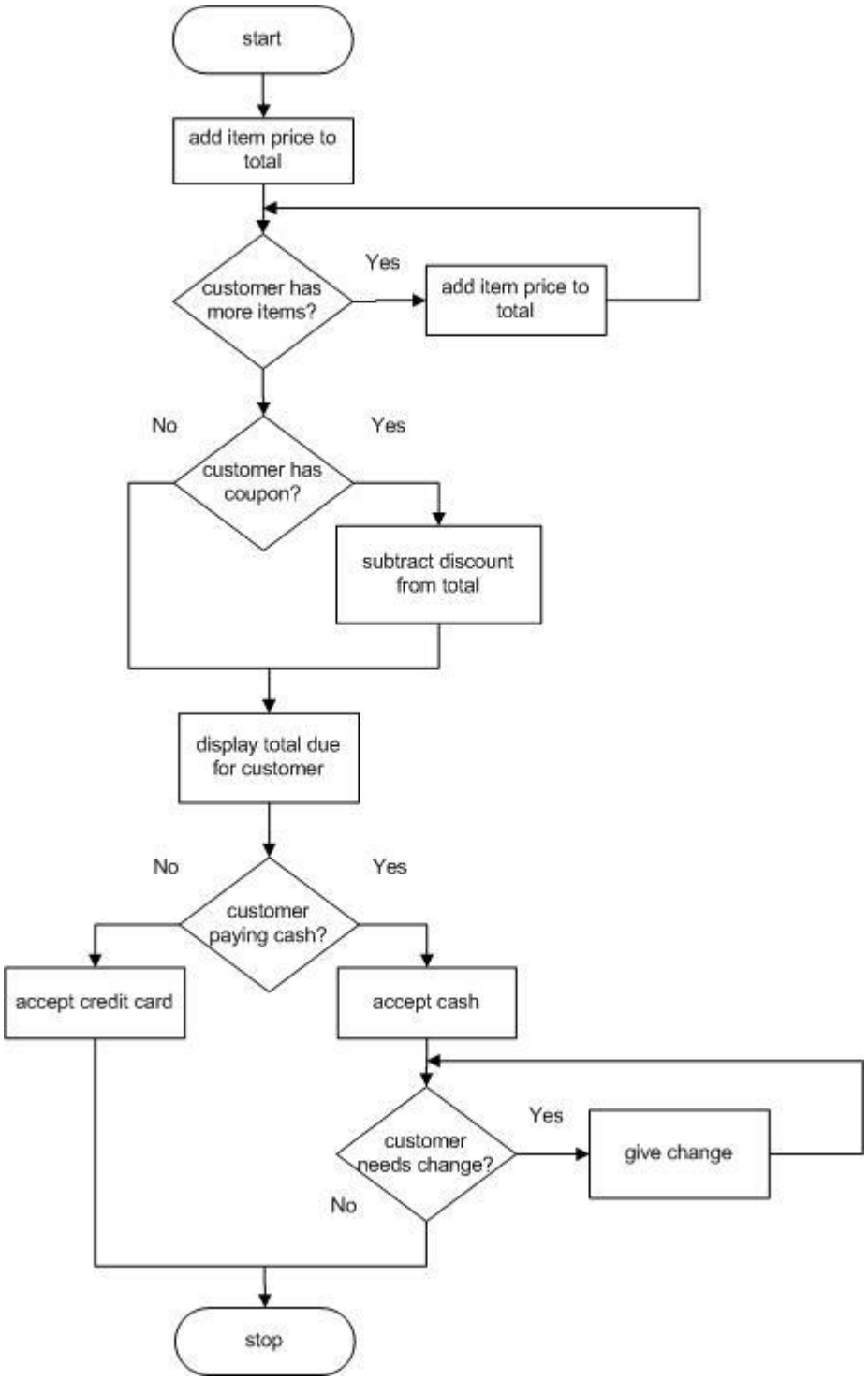
```
start
    if the employee is full-time is true then
        weekly pay = 40 * pay rate
        if employee worked overtime is true then
            overtime pay = (hours worked – 40) * 1.5 * pay rate
            weekly pay = weekly pay + overtime pay
        endif
    else
        weekly pay = hours worked * pay rate
    endif
    net pay = weekly pay - taxes
stop
```

10. Draw a structured flowchart or write structured pseudocode describing the steps a retail store employee should follow to process a customer purchase. Include at least two decisions.

Answer:

Answers will vary. An example solution is shown below.

Flowchart:



Pseudocode:

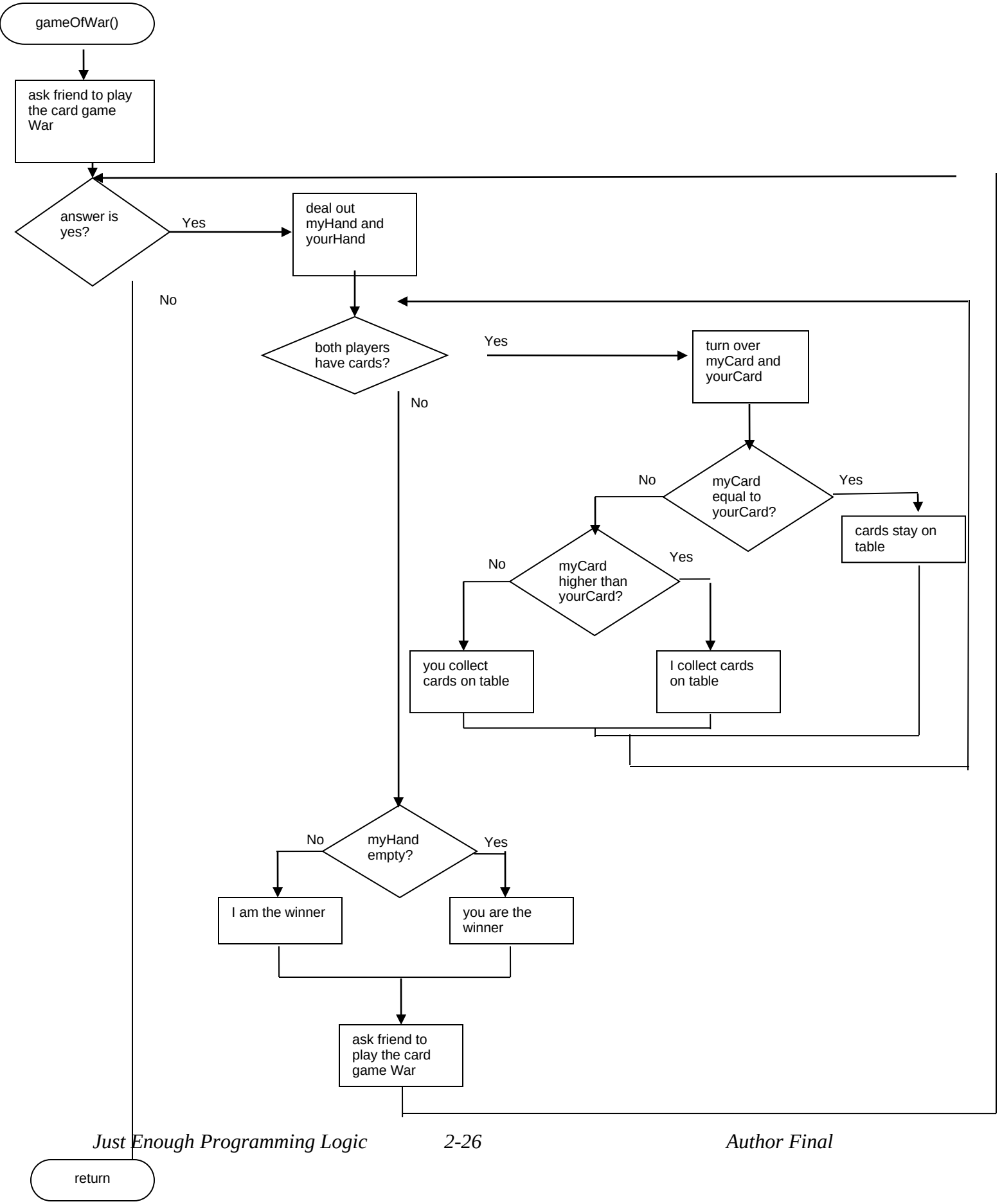
```
start
   add item price to total
   while customer has more items is true
       add item price to total
   endwhile
   if customer has coupon is true
       subtract discount from total
   endif
   display customer total
   if customer is paying w/cash is true
       accept cash
       while customer needs change is true
           give change
       endwhile
   else
       swipe credit card
   endif
stop
```

11. Choose a very simple children's game and describe its logic, using a structured flowchart or pseudocode. For example, you might try to explain Rock, Paper, Scissors; Musical Chairs; Duck, Duck, Goose; the card game War; or the elimination game Eenie, Meenie, Minie, Moe.

Answer:

Answers will vary. The following is a possible solution for the card game War.

Flowchart:


gameOfWar()
ask friend to play the card game War
answer is yes?
Yes
No
deal out myHand and yourHand
both players have cards?
Yes
No
turn over myCard and yourCard
myCard equal to yourCard?
No
Yes
cards stay on table
myCard higher than yourCard?
No
Yes
you collect cards on table
I collect cards on table
myHand empty?
No
Yes
I am the winner
you are the winner
ask friend to play the card game War
return

Pseudocode:

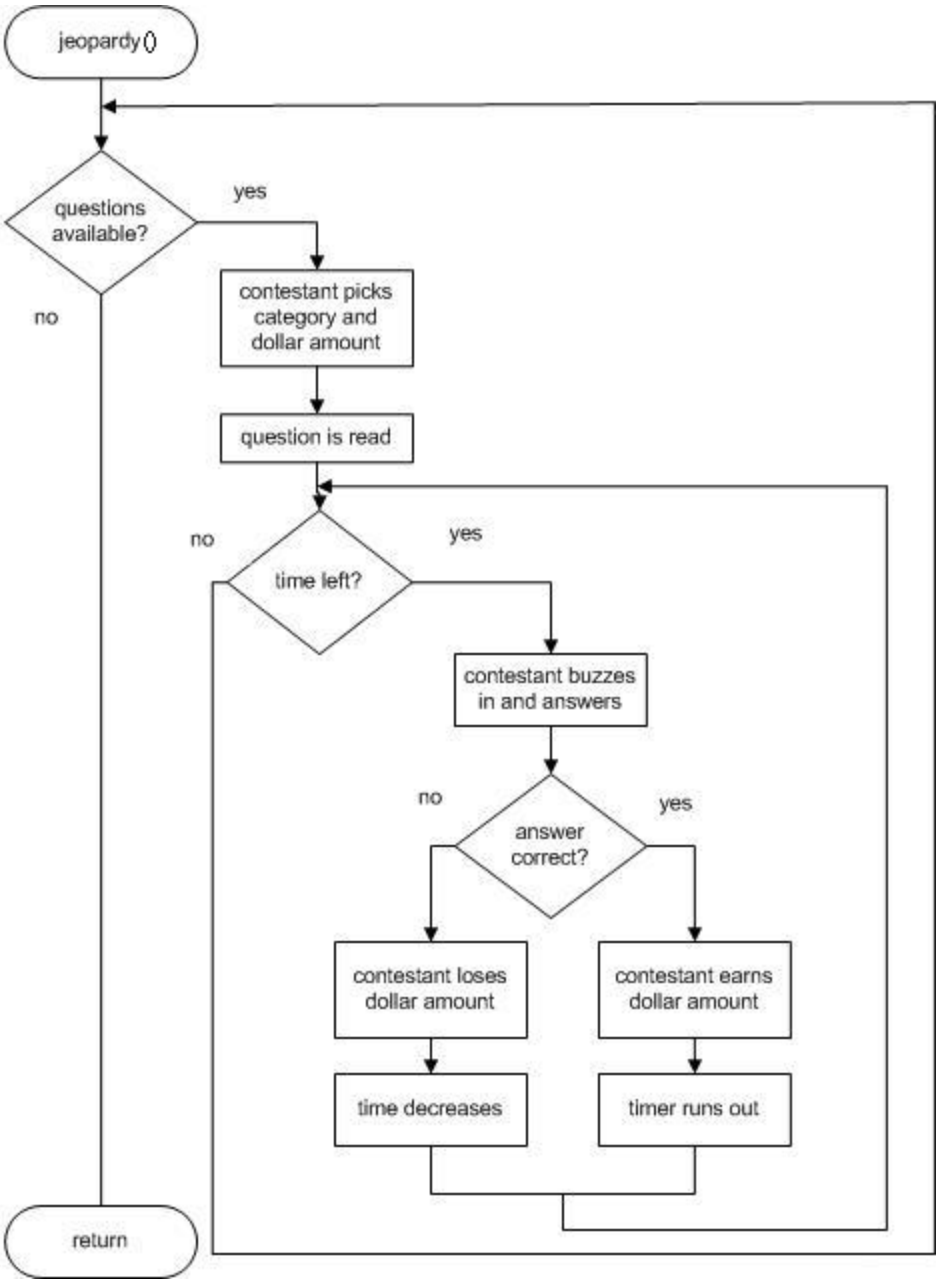
```
gameOfWar()
    ask friend to play the card game War
    while answer is yes
         deal out myHand and yourHand
         while both players have cards
               turn over myCard and yourCard
               if myCard is equal to yourCard then
                     cards stay on table
               else
                     if myCard is higher than yourCard
                           I collect all cards on table
                     else
                           you collect all cards on table
                     endif
               endif
         endwhile
         if myHand is empty is true
               you are the winner
         else
               I am the winner
         endif
         ask friend to play the card game War
    endwhile
return
```

12. Choose a television game show such as Deal or No Deal or Jeopardy! and describe its rules using a structured flowchart or pseudocode.

Answer:

Answers will vary. The following is a possible solution for Jeopardy!.

Flowchart:


jeopardy()
questions available?
yes
no
contestant picks category and dollar amount
question is read
no
yes
time left?
contestant buzzes in and answers
no
yes
answer correct?
contestant loses dollar amount
contestant earns dollar amount
time decreases
timer runs out
return

Pseudocode:

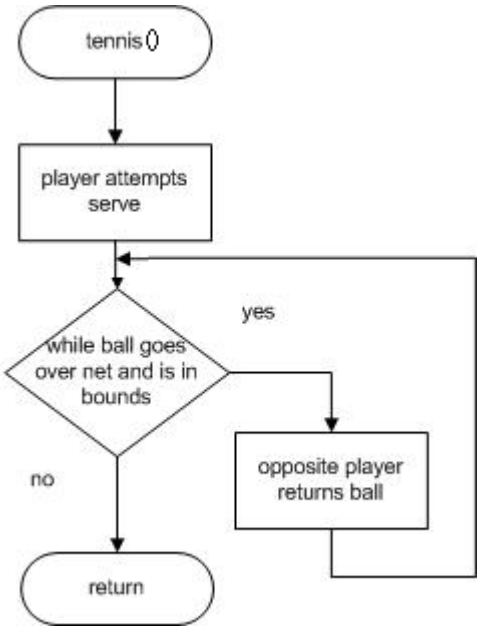
```
jeopardy()
     while questions are available
          contestant picks category and dollar amount
          question is read
          while the timer hasn't run out
                contestant buzzes in and answers
                if answer is correct
                      contestant earns dollar amount
                      time runs out
                else
                      contestant loses dollar amount
                      time decreases
                endif
          endwhile
     endwhile
return
```

13. Choose a professional sport such as baseball or football and describe the actions in one play period using a structured flowchart or pseudocode.

Answer:

Answers will vary. The following is a very simple example solution for tennis.

Flowchart:



Pseudocode:

```
tennis()
  player attempts serve
  while ball goes over net and is in bounds
       opposite player returns ball
  endwhile
return
```

REVIEW QUESTIONS

REVIEW QUESTIONS

1. Snarled program logic is called _____ code.

   a. snake

   b. spaghetti

   c. string

   d. gnarly

2. A sequence structure can contain _____.

   a. any number of tasks

   b. exactly three tasks

   c. no more than three tasks

   d. only one task

3. Which of the following is not another term for a selection structure?

   a. decision structure

   b. if-then-else structure

   c. dual-alternative if structure

   d. loop structure

4. The structure in which you ask a question, and, depending on the answer, take some action and then ask the question again, can be called all of the following except _____.

   a. iteration

   b. loop

   c. repetition

   d. if-then-else

5. Placing a structure within another structure is called _____ the structures.

   a. stacking

   b. untangling

   c. building

   d. nesting

6. Attaching structures end to end is called _____.

   a. stacking

   b. untangling

   c. building

   d. nesting

7. The action or actions that occur within a loop are known as the _____.

   a. loop mass

   b. reiterations

   c. loop body

   d. nested statements

8. The statement `if age >= 65 then seniorDiscount = "yes"` is an example of a _____.

   a. sequence

   b. loop

   c. dual-alternative selection

   d. single-alternative selection

9. The statement `if age < 13 then movieTicket = 4.00 else movieTicket = 8.50` is an example of a _____.

   a. sequence

   b. loop

c. dual-alternative selection

d. single-alternative selection

10. Which of the following attributes do all three basic structures share?

a. Their flowcharts all contain exactly three processing symbols.

b. They all contain a decision.

c. They all have one entry and one exit point.

d. They all begin with a process.

11. When you read input data in a loop within a program, the input statement that precedes the loop _____.

a. is the only part of the program allowed to be unstructured

b. cannot result in `eof`

c. is called a priming input

d. executes hundreds or even thousands of times in most business programs

12. A group of statements that execute as a unit is a _____.

a. block

b. family

c. chunk

d. cohort

13. Which of the following is acceptable in a structured program?

a. placing a sequence within the true half of a dual-alternative decision

b. placing a decision within a loop

c. placing a loop within one of the steps in a sequence

d. All of these are acceptable.

14. Which of the following is not a reason for enforcing structure rules in computer programs?

a. Structured programs are clearer to understand than unstructured ones.

b. Other professional programmers will expect programs to be structured.

c. Structured programs usually are shorter than unstructured ones.

d. Structured programs can be broken down into modules easily.

15. Which of the following is true of structured logic?

a. You can use structured logic with newer programming languages, such as Java and C#, but not with older ones.

b. Any task can be described using some combination of the three structures.

c. Structured programs require that you break the code into modules.

d. All of these are true.