(20%) Light Bot 2.0 Programming:

Given that the instructions for the light bot are:

S-Step, J-Jump, L-Left, R-Right, P-Power

Answer these first two questions in the space on the back of your scantron.

P1: (5 points) Solve the following puzzle, make sure your solution is optimized and you use the iteration notation (e.g. 2:L) whenever possible:

![Light Bot Puzzle]

P2: (5 points) Given the definition of DoPile function:

```c
// Jump Jump Jump Power
F. DoPile () 3:j P.
```

Solve the above puzzle by calling the given DoPile function. This is to say, you can use any instructions, but you should call DoPile whenever possible. Make sure your solution is optimized.

(40%) Bits and Bytes

1. What is the value of p AND (p OR q) if p is 1 and q is 0? A. 0 B. 1
2. What is the value of p AND (p OR q) if p is 0 and q is 1? A. 0 B. 1
3. What is the value of (p OR q) OR (NOT r) if p is 0, q is 0, and r is 0? A. 0 B. 1
4. What is the value of (p OR q) OR (NOT r) if p is 1, q is 0, and r is 1? A. 0 B. 1
5. What is decimal 52 in binary? A. 11010 B. 110100 C. 101100 D. 110101 E. 101101
6. How many bits do we need to represent 35? A. 3 B. 4 C. 5 D. 6 E. 8
7. What is the largest decimal number that can be represented with 5 bits? A. 15 B. 16 C. 31 D. 32 E. 63
8. Deleting a file on a computer (using normal delete) is like
   A. Shredding a document in a document shredder.
   B. Removing an entry from the table of contents or index of a magazine without removing the actual article from the pages.
   C. Tearing a page out of a book or magazine.
   D. Using whiteout to cover up some words in a printed document.
   E. Erasing writing on a chalk/white board.

![Logic gate diagram]

9. This circuit is used as a building block in doing what basic computer operation? The upper logic gate is XOR (exclusive-or) and the lower is AND.
   A. Reset  B. Negation  C. Equals check  D. Jump  E. Addition

10. Binary number arithmetic: compute the following summation. abcd are the carry bits (1 or 0) and eghij is the resulting sum.

   \[
   \begin{array}{cccc}
   a & b & c & d \\
   1 & 0 & 1 & 1_2 \\
   + & 1 & 1 & 0 & 0_2 \\
   \hline
   e & f & g & h & i & j
   \end{array}
   \]

   A. abcd = 1011, eghij=100110
   B. abcd = 1011, eghij=100100
   C. abcd = 0011, eghij=100101
   D. abcd = 0011, eghij=100110
   E. abcd = 0011, eghij=100100

11. On a CD-ROM, we read off the following sequence (first bit read is on the left), you are told each number is represented by 5 bits.

   Start:
   \[1 0 1 1 0 0 1 0 1 0 0 1 1 1 1 0 0 1 1 0 0 1 0 0 1 0\]

   How many numbers does the above sequence of bits represent?
   A. 1  B. 2  C. 4  D. 6  E. 8

12. Convert the very first number recorded on this CD ROM to decimal.
   A. 19  B. 20  C. 21  D. 22  E. 23

   For floating point RGB color representation, connect the following color description to the best RGB values. Use each letter at most once. One will go unused.

   14. Bright red  ____  B. fill(255, 175, 175)
   15. Light red  ____  C. fill(50, 255, 200)
   16. Not red or grey  ____  D. fill(200, 200, 200)
   E. fill(255, 0, 0)
Decode the following ASCII values using the ASCII code table provided below. For example, the ASCII value for the letter “A” is “01000001”.

<table>
<thead>
<tr>
<th>ASCII</th>
<th>00000000</th>
<th>00000001</th>
<th>00000010</th>
<th>00000011</th>
<th>00000100</th>
<th>00000101</th>
<th>00000110</th>
<th>00000111</th>
<th>00001000</th>
<th>00001001</th>
<th>00001010</th>
<th>00001011</th>
<th>00001100</th>
<th>00001101</th>
<th>00001110</th>
<th>00001111</th>
</tr>
</thead>
<tbody>
<tr>
<td>0011</td>
<td>0 1 2 3 4 5 6 7 8 9 : ; &lt; = &gt; ?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0100</td>
<td>@ A B C D E F G H I J K L M N O</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0101</td>
<td>P Q R S T U V W X Y Z [ \ ] ^ _</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0110</td>
<td>a b c d e f g h i j k l m n o</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0111</td>
<td>p q r s t u v w x y z {</td>
<td>} ~ \r</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

17. 01001110  A. g  B. N  C. t  D. v
18. 01100111  A. g  B. N  C. t  D. v

19. Decode this message 110000100110 given this Huffman Tree.

- A. ROBOT
- B. Rotor
- C. TREE
- D. ROOT
- E. REBOOT

20. Which of these is a Huffman tree for these letter frequencies g:2, r:4, m:5, o:5, e:11?

- D. Both A and B are fine.
- E. All three, A, B, and C are fine.
(24%) Programming:

21. What does this program display?
   ```java
   void setup() {
       size(200, 200);
   }
   void draw() {
       background(255);
       int xPos = 0;
       ellipse(xPos, height/2, 20, 20);
       xPos = xPos + 1;
   }
   ```
   A. circle moving across the screen left to right
   B. circle moving across the screen right to left
   C. circle moving across the screen top to bottom
   D. circle moving across the screen bottom to top
   E. half-circle on the left edge not moving

22. What does this program display?
   ```java
   void setup() {
       size(500,500);
       noFill();
   }
   int diameter = 0;
   void draw() {
       ellipse(width/2, height/2, diameter, diameter);
       diameter = diameter + 15;
   }
   ```
   A. many nested circles (like a target) growing in size
   B. a white circle growing in size
   C. a black circle growing in size
   D. a pulsing images of circles growing and shrinking
   E. nothing (a circle with diameter 0)

23. In Java, if x and y are integer variables with values 11 and 4 respectively, what is the value of the expression x%y?  
   A. 2  
   B. 3  
   C. 4

24. In Java, if x and y are integer variables with values 11 and 4 respectively, what is the value of the expression x/y?  
   A. 2  
   B. 2.75  
   C. 3

   Given the following code, what are the values of x, y, and z after the code executes?
   ```java
   int x, y, z;
   x = 3;
   y = 7;
   z = x + y;
   y = y + z;
   x = x + x;
   ```

   25. The value of x is  
   A. 3  
   B. 6

   26. The value of y is  
   A. 7  
   B. 17

   27. The value of z is  
   A. 10  
   B. 23
28. What goes in the blank so that the ball moves back and forth, reversing direction whenever it reaches the edge?
```java
int ballX, ballDia = 50, speed = 1;
void setup() {
    size(400,400);
    ballX = ballDia/2;
}
void draw() {
    background(120);
    if (ballX > width-ballDia/2) {
        speed = -1;
    } else _________________________ {
        speed = 1;
    }
    ellipse(ballX, height/2, ballDia, ballDia);
    ballX = ballX + speed;
}
```
A. (ballX > ballDia/2)
B. (ballX < ballDia/2)
C. Leave it blank (as is).
D. if(ballX > ballDia/2)
E. if(ballX < ballDia/2)

29. What best describes the behavior of this program?
```java
color bc = color(255,0,0);
void draw() {
    background(bc);
}
void mousePressed() {
    if (mousePressed) {
        bc = color(255,0,0);
    }
    else {
        bc = color(0,255,0);
    }
}
```
A. The background is red when you are holding down the mouse button and green if not holding down the mouse button.
B. The background switches between red and green each time the mouse is pressed.
C. The background is always green.
D. The background is always red.
30. What best describes the behavior of this program?

```java
color bc = color(255,0,0);
void draw() {
    background(bc);
    if (mousePressed) {
        bc = color(255,0,0);
    } else {
        bc = color(0,255,0);
    }
}
```

A. The background is red when you are holding down the mouse button and green if not holding down the mouse button.
B. The background switches between red and green each time the mouse is pressed.
C. The background is always green.
D. The background is always red.

31. What best describes what this program does?

```java
int ballX, ballDia = 50;
void setup() {
    size(400,400);
    ballX = -ballDia/2;
}
void draw() {
    background(120);
    if (ballX > width+ballDia/2)
        ballX = -ballDia/2;
    ellipse(ballX, height/2, ballDia, ballDia);
    ballX = ballX + 1;
}
```

A. Ball moves across moving off the right edge then moves back in from the left edge.
B. Ball moves across until half way off the right edge (showing just a half circle) then reappears as a half circle on the left edge.
C. Ball moves across then disappears and doesn’t come back.
D. Ball moves left to right then right to left after reaching the right edge, and repeats.
E. Ball moves across jumping back to left edge as soon as it touches the right edge.

32. Where should the line “background(255);” be placed so that the sketch shows just a single moving rectangle?

```java
void setup() {
    size(400, 400);
}
```

// position A

```java
rect(pmouseX, pmouseY, mouseX, mouseY);
```

// position B

```java
fill(255-abs(mouseX-pmouseX));
```

// position C

```java
// Choose answer E if it would work with either C or D.
```
(16%) Others

33. In Blown to Bits chapter 3 the authors write “In Orwell’s imagined London, only O’Brien and other members of the Inner Party could escape the gaze of the telescreen. For the rest, the constant gaze was a source of angst and anxiety.” Orwell’s vision does not match reality today because
   A. today many if not most people willingly accept “the gaze” and the benefits that they get from doing so.
   B. today most monitoring of “the gaze” is done by the government (NSA, FBI, etc) where in Orwell’s London neighbors spied on neighbors.
   C. Both A and B

34. The invention of the transistor
   A. allowed computers to be smaller and faster.
   B. fundamentally changed how computers compute.
   C. both A and B.

35. Which of these is NOT one of the “Seven Big Ideas” in computing defined by the College Testing Board for the new AP Computing Principles course?
   A. Algorithms are tools for developing and expressing solutions to computational problems
   B. Programming is a creative process that produces computational artifacts
   C. Digital devices, systems, and the networks that interconnect them enable and foster computational approaches to solving problems
   D. Computing enables innovation in other fields, like science, engineering, humanities, etc.
   E. All four of the above are on the list of “Seven Big Ideas.”

36. Which of these is NOT one of the “Seven Big Ideas” in computing defined by the College Testing Board for the new AP Computing Principles course?
   A. Data and information help to create knowledge.
   B. Computing is a creative human activity that enables innovation
   C. Abstraction is a way to understand and solve problems
   D. The video game industry is now more important (larger) than the film industry.
   E. All four of the above are on the list of “Seven Big Ideas.”

37. Which of these is NOT part of a person’s digital footprint?
   A. What ATMs you use and when.
   B. Where you go when carrying a “smart” phone.
   C. What you buy at Safeway using a credit card.
   D. A cash purchase at a pizza parlor.
   E. What web sites you visit.

38. Run length encoding (e.g. storing 1111111110011111 as 10,2,6) was presented as an example of
   A. an alternative to ASCII coding.
   B. a basic encryption algorithm.
   C. a form of lossless compression.
   D. a form of lossy compression.

   (TWO MORE TO GO – TURN THE PAGE)
39. Which of these is not meta-data?
   A. Edit histories as those created with “track changes” in MS Word documents.
   B. Time and camera settings stored in a digital camera image.
   C. File creation and modification dates stored in pdf files.
   D. Formatting information in an html file.
   E. Phone numbers in a contact list

40. The key difference between the early tabulating machines and modern computers is
   A. mechanical vs electrical
   B. decimal vs binary
   C. non-programmable vs programmable
   D. B and C
   E. A, B, and C