



Lesson 11 Normal Distribution

Worksheet

K-W-L Chart

What I Know	What I Wonder	What I Learned

New Commands: make a list of all the new Python commands you learn throughout the lesson

Activity 1:

Read the program.

```
1. import cyberpi, random
2.
3. cyberpi.display.clear()
4.
5. n = int(input("The number of times to roll 2 dice: "))
6. t = 0
7. sum_list = [2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]
8. count_list = [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
9.
10. while t < n:
11.     dice_x = random.randint(1, 6)
12.     dice_y = random.randint(1, 6)
13.     print("(", dice_x, ",", dice_y, ")")
14.     result = dice_x + dice_y
15.     t += 1
16.     sum_index = sum_list.index(result)
17.     count_list[sum_index] += 1
18.
19. cyberpi.display.set_brush(128, 0, 0)
20. cyberpi.barchart.add(round(count_list[0]/n * 200, 2))
21. cyberpi.display.set_brush(220, 20, 60)
22. cyberpi.barchart.add(round(count_list[1]/n * 200, 2))
23. cyberpi.display.set_brush(255, 0, 0)
24. cyberpi.barchart.add(round(count_list[2]/n * 200, 2))
25. cyberpi.display.set_brush(205, 92, 92)
26. cyberpi.barchart.add(round(count_list[3]/n * 200, 2))
27. cyberpi.display.set_brush(233, 150, 122)
28. cyberpi.barchart.add(round(count_list[4]/n * 200, 2))
29. cyberpi.display.set_brush(255, 69, 0)
30. cyberpi.barchart.add(round(count_list[5]/n * 200, 2))
31. cyberpi.display.set_brush(255, 165, 0)
32. cyberpi.barchart.add(round(count_list[6]/n * 200, 2))
33. cyberpi.display.set_brush(255, 215, 0)
34. cyberpi.barchart.add(round(count_list[7]/n * 200, 2))
35. cyberpi.display.set_brush(240, 230, 140)
36. cyberpi.barchart.add(round(count_list[8]/n * 200, 2))
37. cyberpi.display.set_brush(255, 255, 0)
38. cyberpi.barchart.add(round(count_list[9]/n * 200, 2))
39. cyberpi.display.set_brush(154, 205, 50)
40. cyberpi.barchart.add(round(count_list[10]/n * 200, 2))
```

**Answer:**

- What are the modules imported in this program;
- What are the variables displayed in the bar chart;
- Are '**sum_list**' and '**count_list**' variables? What are the values of them?
- Which function sets the colour of the bar chart;
- How are the bars created

Draw a Flowchart for the example program:

**Activity 2:**

Task 1: Simulate the experiment of tossing two coins. Calculate all the possible outcomes in this experiment and visualise the distribution with a bar chart.

Task 2: Think about this and fill the table below. When tossing a coin three times and what is the probability of getting three heads, two heads, one head, and no head?

- Plot a graph on CyberPi's screen to demonstrate all the possible outcomes.
- List all the possible outcomes and calculate the probabilities for each event.

Head, Head, Head	  

Task 3: Program CyberPi to set the bar colour and the numeric values represented by the bars.

Extension:

Calculate the normal distribution using a formula:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

- $f(x)$ is the probability density function
- σ is the standard deviation
- μ is the mean
- x is the random variable

Plot this formula onto CyberPi and compare to the initial graph you created in **Activity 2**