模擬與統計計算 HW1

大數法則模擬

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實作:

骰子模擬器

目的:

藉由實作骰子模擬器及計算其模擬出來的機率並與理論值比較其差別，了解大數法則。

步驟:

1. 編寫一個能模擬擲骰子以及計算各點數被骰到機率的函式(figure 1)。

```python
def roll_dices(times):
    """ simulate rolling the dice
    and return probability list of simulation  """
    count_list = [0,0,0,0,0,0]
    for i in range(times):
        x = random.choice([1,2,3,4,5,6])#dice points 1 to 6
        count_list[x-1]+=1#counting how many times we get the point

    prob_list = [] # to store prob
    for j in range(len(count_list)):
        prob_list.append(count_list[j]/times)#probability counting

    return prob_list
```

Fig. 1: 程式碼(骰子模擬器以及計算機率)

2. 編寫一個能列印 X 軸:擲骰子次數出 Y 軸:各點數被骰到的機率的圖表的式 (Figure 2)。

```python
def draw_dice_prob(time_start,time_end,interval):
    """"draw picture"""
    prob1 = []
    prob2 = []
    prob3 = []
    prob4 = []
    prob5 = []
    prob6 = []
    theor_prob = []

    for i in range(time_start,time_end,interval):
        prob = roll_dices(i)

        prob1.append(prob[0])
        prob2.append(prob[1])
        prob3.append(prob[2])
        prob4.append(prob[3])
        prob5.append(prob[4])
        prob6.append(prob[5])
        theor_prob.append(1/6)

    x_diff = range(time_start,time_end,interval)

    plt.figure(figsize = (12, 8))
    plt.plot(x_diff,prob1,label = 'one')
    plt.plot(x_diff,prob2,label = 'two')
    plt.plot(x_diff,prob3,label = 'three')
    plt.plot(x_diff,prob4,label = 'four')
    plt.plot(x_diff,prob5,label = 'five')
    plt.plot(x_diff,prob6,label = 'six')
    plt.plot(x_diff,theor_prob,linewidth = 8,label = 'theoretical probability')
    plt.xlabel("number of times")
    plt.ylabel("probability")
    plt.legend()
    plt.show()
```
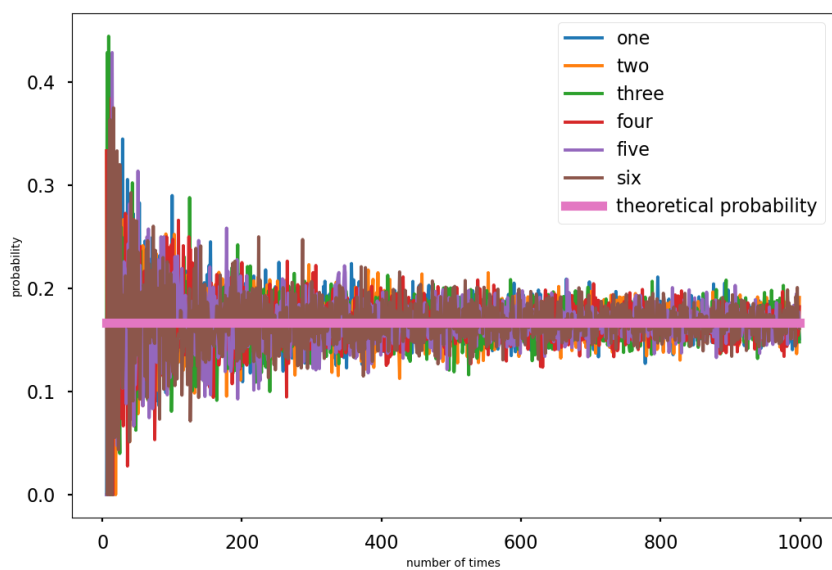
Fig. 2: 程式碼(圖表製作)

3. 觀察圖表(Figure 3)。

Fig. 3 :機率圖表(X 軸: 擲骰子次數，Y 軸: 機率)

結論:

由 Figure 3 可得知當我們擲骰子的次數越多,實驗機率會越接近理論機率,相反的,次數越少,則誤差越大,這現象也就是所謂的大數法則。