Physics 406 Homework #1 9/14/94

1. a) Each die has six distinct faces, so there are 6 x 6 = 36 different outcomes.

b) There is only one way of getting a two (1+1), so:

$$P_2 := \frac{1}{36} \qquad P_2 = 0.02778$$

c) There are two ways of getting a three: 1+2 and 2+1:

$$P_3 := \frac{2}{36} \qquad P_3 = 0.05556$$

d) There are two ways of getting an eleven, (5+6 and 6+5), and six ways of getting a seven, 3+4, 4+3, 2+5, 5+2, 1+ and 6+1. Hence there are eight ways of getting a natural.

$$P_{natural} := \frac{8}{36} \qquad P_{natural} = 0.222 \qquad \frac{1}{P_{natural}} = 4.5$$

e) The probability of getting a natural is one in 4.5 so if the house were to pay fairly it should give 4.5 dollars for ev dollar bet. Paying even money is NOT fair for this bet.

f) There is only one way to get a "12", Thus craps occurs 4 ways: 1+1, 2+1, 1+2, 6+6.

$$P_{craps} := \frac{4}{36} \qquad P_{craps} = 0.111$$

g) $$P_{not\_natural\_and\_not\_craps} := 1 - P_{craps} - P_{natural}$$

$$P_{not\_natural\_and\_not\_craps} = 0.667$$

h) Six occurs five ways: 1+5, 5+1, 4+2, 2+4, 3+3, and eight occurs five ways: 6+2, 2+6, 3+5, 5+3, and 4+4. Thus Big 6 or Big 8 occurs 10 ways.

$$P_{Big6\_Big8} := \frac{10}{36} \qquad P_{Big6\_Big8} = 0.27778 \qquad \frac{1}{P_{Big6\_Big8}} = 3.6$$

Again, this is NOT fair in terms of the chances take. The probability is 1 in the three. So the bettor should be paid three dollars and 60 cents in winning the bet, not one dollar.

2. a.) There are eight letters in the word "hawaiian", with a double "i" and a triple "a". Then the number of distinct permutations of the eight letters is

$$P := \frac{8\,!}{2\,!\cdot 3\,!} \qquad P = 3360$$

b) In order to find the number of six letter permutations that can be made from this word we need to separate the problem into cases that correspond the possible "missing" letters.

Case 1: Only non-repeating letters are missing (a,w,n). Then we have a six letter word with the double "i" and the triple "a".

$$C_1 := 3\cdot\frac{6\,!}{2\,!\cdot 3\,!} \qquad C_1 = 180$$

We multiply by three because there are three possible non-repeating letters that can be this word.

Case 2: One non-repeating letter is missing, along with one "i"

$$C_2 := 3\cdot\frac{6\,!}{3\,!} \qquad C_2 = 360$$

Case 3: One non-repeating letter is missing, along with one "a"

$$C_3 := 3\cdot\frac{6\,!}{2\,!\cdot 2\,!} \qquad C_3 = 540$$

Case 4: Both "i's" are missing

$$C_4 := \frac{6\,!}{3\,!} \qquad C_4 = 120$$

Case 5: Two "a's" are missing

$$C_5 := \frac{6\,!}{2\,!} \qquad C_5 = 360$$

Case 6: One "i" and one "a" are missing

$$C_6 := \frac{6\,!}{2\,!} \qquad C_6 = 360$$

$$\text{Total} := C_1 + C_2 + C_3 + C_4 + C_5 + C_6 \qquad \text{Total} = 1920$$

3. a.) If we were to write out this number by hand it would be a "1" followed by 100 "0's". Thus it is a 101 digit number. It would begin: 10,000,... with 33 groups of 000,. Therefore it will have 33 commas. Thus it will require 134 characters. At 10 characters per inch it will require 13.4 inches (Almost twice the width of this page!).

b.) $x := 10^{100}$ or $x := 10^{\left(10^2\right)}$

$y := x^x$ $\quad y := \left[10^{\left(10^2\right)}\right]^x$ $\quad y := 10^{\left(10^2\right)\cdot x}$

$y := 10^{\left(10^2\right)\cdot 10^{100}}$ $\quad y := 10^{\left(10^{102}\right)}$

Therefore: $z := 10^{102}$