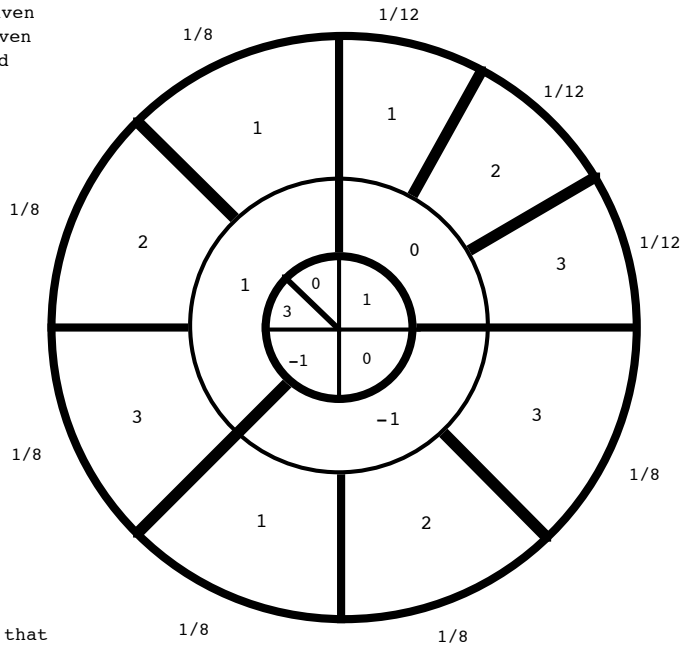
1. Suppose that the random variables X,Y,Z are obtained by spinning the adjoining roulette, with X given by the innermost circle, Y given by the intermediate circle and Z given by the outer circle.



a) Calculate P[X=3,Y=1]

b) Are X and Y independent?
Are X and Z independent?
Are Y and Z independent?

c) Is any one of these variables dependent on the others?

d) Calculate E(X)

e) Calculate P[X=0|Z=1 or 3]

f) Calculate E(Z|X=0)

g) Suppose you bet 1 dollar that X+Z=2. Suppose you win w dollars if X+Z=2 and lose your dollar otherwise. What value should w have to make this a fair bet.
(Note that the bet is fair if on the average you can expect to break even)

2. As is now usual, we associate to letters of the alphabet the numbers, "space" is 26, $ is 27 and @ is 28. Decrypt the following message

JH@$S YDLEEROLBZTTPHXDTGGQAI

where the Hill matrix is
19 16
11 25
and we are working modulo 29.

3. The following message

DGDDF AFAAF XDFDF DAADA GVVVD
FAAXG GAVFA XAAVA DFFXG FDDDD

was encrypted using the ADFGVX system, with the attached ADFGVX square and the permutation
10 9 2 8 7 6 1 5 4 3

Unfortunately some of the letters in the square were lost as you can see.

Recover the original message.

	A	D	F	G	V	X
A	T	E	L	S	C	O
D	P	I	N			
F	D	F	G			
G	M	Q	U			
V	Y	Z	0			
X	4	5	6			

4. Decrypt the following

AF FV AA GG VD FF DF DD GG FA

knowing that it was encrypted using ADFGVX encipherment scheme and the keys

F	L	U	B	E	R
N	T	S	A	C	D
G	H	I	J	K	M
O	P	Q	V	W	X
Y	Z	0	1	2	3
4	5	6	7	8	9

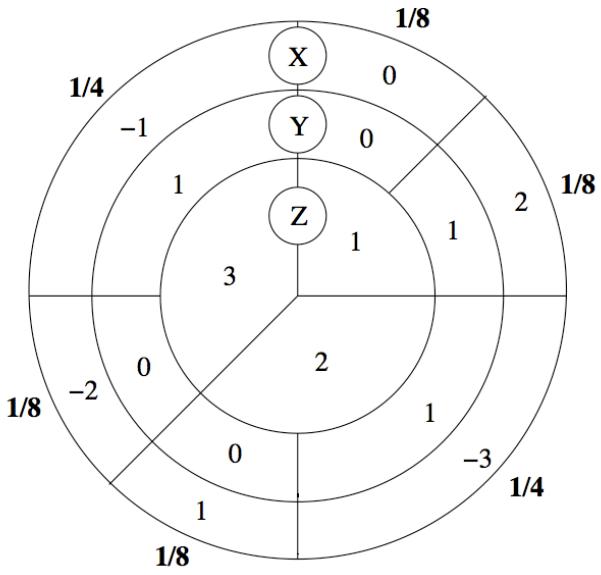
and 3 5 1 7 9 4 10 2 8 6

(1) The random variables X, Y, and Z are determined by spinning the wheel below. Determine the following relations.

(a) are X and Z independent?
(b) are Y and Z independent?

(c) is X dependent on Y?
(d) is Y dependent on X?
(e) is Z dependent on Y?
(f) is Z dependent on X?
(g) is X dependent on Y and Z?

(2) Find the probabilities:
(a) $P(X = 0)$
(b) $P(X = 0 \text{ or } Y = 0)$
(c) $P(X = 0 \text{ and } Y = 0)$
(d) $P(X = 0|Y = 0)$
(e) $P(X = 0|Z = 2)$



#7 The following was encrypted with the snail encipherment system, decrypt it.

IAMSS ANSIS AUTNC KGAOS URANY