Statistics 104 - Laboratory 6

Probabilities and Pass the Pigs™

For many random phenomena, e.g. a fair coin, a balance die, there are theoretical probabilities based on equally likely outcomes. What about a random phenomenon where the outcomes are not equally likely? Consider the dice game Pass the Pigs™. The game has two "dice" shaped like pigs. The object of the game is to roll the pigs and accumulate points based on how they land. The various ways a pig can land is given in the table below.

Position	Name	Description
1	Dot Up	Pig lies on its left side
2	Dot Down	Pig lies on its right side
3	Trotter	Pig stands on all fours
4	Razorback	Pig lies on its spine, with feet skyward
5	Snouter	Pig balances on front two legs and snout
6	Leaning Jowler	Pig balances on front left-leg, snout, and left-ear

Position					
(Dot Up)	**(Dot Down)**	**(Trotter)**	**(Razorback)**	**(Snouter)**	**(Leaning Jowler)**
					

1. Empirical Probability

Last fall Stat 104 students rolled pigs 5,000 times and came up with the following results.

Roll Type	Number of Rolls
 Dot Down	1739
 Dot Up	1431
 Razorback	1256
 Trotter	436
 Snouter	97
 Leaning Jowler	41

Compute relative frequencies (to four decimal places) for last falls' Stat 104 students' rolls and display this information in an appropriate graph.

a) What is the position that occurs most frequently?
b) What is the position that occurs least frequently?
c) Typically in a game, more points would be awarded to positions that have lower frequencies. Assign point values for each of the positions so that more points are awarded to positions that have lower frequencies. Explain your choices.

2. Pass the Pigs™

In the game of pass the pigs, two pigs are rolled at the same time and the combined roll earns points depending on how the pigs land. If you score points, you can roll again to try to score more points or pass the pigs and keep the points you scored for that round. If you roll a "pig out" (one pig dot up and the other pig dot down) you lose any points for that round and have to pass the pigs. No matter how the pigs land if they touch each other, an "oinker", you lose any points for the round and all previous rounds, i.e. you are back to zero for a game score and you have to pass the pigs.

In a paper by John Kern, **"**Pig Data and Bayesian Inference on Multinomial Probabilities," *Journal of Statistics Education*, 2006, 14(3), the results of a pair of pig dice rolled 6,000 times are given. One of the pigs had a blackened nose, the black pig, so it could be differentiated from the other pig with the standard pink nose, the pink pig. The table of frequencies for the 6,000 rolls is reproduced on the next page. **Note that on 23 of the rolls the two pigs ended up touching each other, an "oinker".**

	Pink Pig Position					
Black Pig Position	**(Dot Up)**	**(Dot Down)**	**(Trotter)**	**(Razorback)**	**(Snouter)**	**(Leaning Jowler)**
(Dot Up)	573	656	139	360	56	12
(Dot Down)	623	731	185	449	58	17
(Trotter)	155	180	45	149	17	5
(Razorback)	396	473	124	308	45	8
(Snouter)	54	67	13	47	2	1
(Leaning Jowler)	10	10	0	7	1	1

Based on the 6,000 rolls, what is the probability of

a) an "oinker"?
b) the pink pig is a trotter?
c) the black pig is a trotter?
d) the black pig or the pink pig is a trotter?
e) a double razorback, i.e. black pig is a razorback and pink pig is a razorback?
f) black pig is a razorback or pink pig is a razorback?
g) a "pig out", i.e. one pig has a dot up and the other pig has the dot down?
h) one pig is a snouter and the other pig is either dot up or dot down?
i) one pig is a leaning jowler and the other pig is either dot up or dot down?
j) the black pig being a razorback given the pink pig is a snouter?
k) the pink pig being a razorback given the black pig is a snouter?
l) Are "oinker" and "pig out" mutually exclusive? Explain briefly.
m) Are black pig dot up and pink pig dot up independent? Explain briefly.

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Group Answer Sheet

Names of Group Members: _____, _____

_____, _____

1. Empirical Probability

	Pink Pig Position					
Roller	**(Dot Down)** 	**(Dot Up)** 	**(Razorback)** 	**(Trotter)** 	**(Snouter)** 	**(Leaning Jowler)** 
Stat 104 Fall 2007	1739	1431	1256	436	97	41
Relative Frequency						

Graphical display

a) What is the position that occurs most frequently?

b) What is the position that occurs least frequently?

c) Typically in a game, more points would be awarded to positions that have lower frequencies. Assign point values for each of the positions so that more points are awarded to positions that have lower frequencies.

2. Pass the Pigs™

Based on the 6,000 rolls, what is the probability of

a) an "oinker"?

b) the pink pig is a trotter?

c) the black pig is a trotter?

d) the black pig or the pink pig is a trotter?

e) a double razorback, i.e. black pig is a razorback and pink pig is a razorback?

f) black pig is a razorback or pink pig is a razorback?

g) a "pig out", i.e. one pig has a dot up and the other pig has the dot down?

h) one pig is a snouter and the other pig is either dot up or dot down?

i) one pig is a leaning jowler and the other pig is either dot up or dot down?

j) the black pig being a razorback given the pink pig is a snouter?

k) the pink pig being a razorback given the black pig is a snouter?

l) Are "oinker" and "pig out" mutually exclusive? Explain briefly.

m) Are black pig dot up and pink pig dot up independent? Explain briefly.