ANSC 324

Spring, 2007

EXAM 1

100 Points

NAME:_____KEY_____ Lab section:_____

Instructions:

Make sure that you take time to carefully read each question, and then answer the question appropriately. Answers to essay questions do not necessarily have to be long, but answers need to be complete. Make sure that you pace yourself so that you are able to complete the exam. Don't get stuck on any one question. If you don't know the answer to a question, continue to the next question and come back to the one that you are uncertain about at the end. ***Please write legibly and show all of your work.*** **Good Luck!!!**

1) Define the term “nutrient” (5 pts.):

A nutrient is a chemical component of a feed ingredient that is required for normal body function.

2) What are the 6 nutrient classes (6 pts.)?

Carbohydrates, lipids, minerals, vitamins, proteins, water

3) What is the difference between digestible and metabolizable energy (5 pts.)?

Metabolizable energy is digestible energy minus the gross energy excreted in urine

4) Define an essential amino acid (5 pts.):

An essential amino acid is one that is required by the animal and is either not produced by the animal or not produced by the animal in sufficient quantity to meet the requirement. Therefore, it must be supplied in the die

5) Individual nonessential amino acids are not required in the diet, but a certain quantity of nonessential amino acids are needed in the diet. Why (5 pts.)?

Nonessential amino acids can be synthesized by the animal, but a certain quantity of nonessential amino acids must be provided in the diet to provide carbon skeletons and amino groups, which serve as the building block for amino acid synthesis

6) Define the “first limiting amino acid” (5 pts.):

The first limiting amino acid is the amino acid that is in the diet at the lowest concentration relative to the animals’ requirement.

7) You have just been hired as a nutritionist for a feed company that supplies feed to several wean to finish swine operations. Your first task is to formulate a new grower 1 diet (60-100 lb pigs) that includes distiller's dried grains with solubles (DDGS). You are concerned about putting to much DDGS in the diet, so you decide to limit the inclusion of DDGS to 15% of the corn inclusion level. Given the following information, formulate a corn-SBM-DDGS based diet to meet the CP requirement for 60-100 lb pigs.

z = DDGS = 27% CP
x = Corn = 8.3% CP
y = SBM = 47.5% CP

Leave 2.5% space for premixes.

$60 lb / 2.2 = 27 kg$

$CP_{req} = 18\%$

$x + y + z = 97.5$

$z = .15x$

$.083x + .475y + .27z = 18$

$(1.15x + y = 97.5)(-.475)$

$.0405x$

$.083x + .475y + .27(.15x) = 18$

$.124x + .475y = 18$

$-.546x - .475y = -46.31$

$-.422x = -28.31$

$x = 67.09\%$ corn

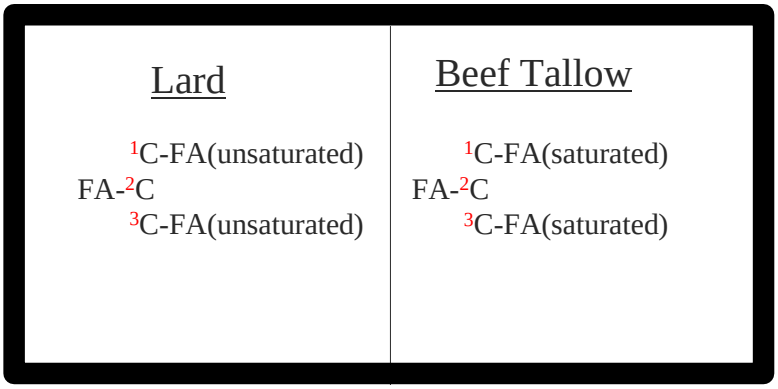
$z = .15(67.09)$

$= 10.06\%$ DDGS

$y = 97.5 - 67.09 - 10.06$

$= 20.35\%$ SBM

8) Explain why the fat from lard is more digestible/available than the fat from beef tallow (6 pts.).



Free fatty acids and monglycerides are absorbed across the brush border membrane. Unsaturated fats are absorbed more readily than saturated fatty acids, and lipase cleave fats from the 1 and 3 carbons of glycerol.l Therefore, the fatty acid profile of a triglyceride will affect the ME value of that particular fat. For example, lard contains unsaturated fatty acids on carbons 1 and 3 of the glycerol, whereas beef tallow contains saturated fatty acids on carbons 1 and 3 of glycerol. As a result, the fatty acids in lard are more available to the animal than the fatty acids in beef tallow, resulting in a higher ME value for lard compared to beef tallow.

9) (8 pts.) Given the following information, calculate the **Metabolizable** energy content of this diet (kcal/kg) on an as-fed basis:

Gross energy content of the feed = 4,400 kcal/kg

1,300 g of feed are consumed:
- 205 g of feces are collected (2.9 kcal/g)
- 4150 ml of urine are collected (0.15 kcal/ml)

$205/1.3 \times 2.9 = 457.3$ Kcal fecal energy

$4150/1.3 \times .15 = 478.8$ Kcal urine energy

$ME = 4400 - 457.3 - 478.8$

ME = 3463.9 Kcal/kg

10) You have purchased a TM premix. Based on the information provided below, how much of this premix do you need to add to the diet to meet the mineral requirements of a 165 lb. pig (12 pts.)? State your answer as the percent inclusion level of the premix needed in your diet.

mg/kg

Ingredient	Amount		
Iron	75.00	g/lb	x 1000 x 2.2 = 165,000
Zinc	75.00	g/lb	165,000
Manganese	9.80	g/lb	21,560
Copper	6.16	g/lb	13,552
Iodine	0.35	g/lb	770

11) 165/2.2 = 75 kg pig

Fe = 50 mg/kg / 165,000 x 100 = .003%

Zn = 50 mg/kg / 165000 x 100 = .003%

Mn = 2 mg/kg / 21,560 x 100 = .009%

Cu = 3.5 mg/kg / 13552 x 100 = .026%

I = .14 mg/kg / 770 x 100 = .018%

Premix should be included at .026% of the diet

Describe the process of protein digestion and absorption. Begin with feed intake and end with absorption of amino acids and/or peptides. Include the chemical and enzymatic degradation of proteins and differences which exist in absorption of amino acids or peptides (12 pts.).

Protein digestion begins in the stomach, where HCl acid is secreted from parietal cells and begins to denature proteins. Simultaneously, chief cells secrete pepsinogen, which is converted to pepsin by the acidic environment of the stomach. Pepsin catalyzes the hydrolysis of peptide bonds, particularly between aromatic amino acids. Digesta then moves from the stomach to the small intestine, where the pancreas secrets a host of proteolytic enzymes via the common bile duct. All of these proteolytic enzymes are secreted in an inactive form know as zymogens, and are activated once in the lumen of the gut. Proteolytic enzymes secreted from the pancreas can be broken into two main categories: endopeptidases and exopeptidases. Endopeptidases catalyze the hydrolysis of internal peptide bonds, while exopeptidases catalyze the hydrolysis of peptide bonds at the C- or N-terminus. Specific endopeptidases include: Trypsin (site of action: carboxyl side of Lys and Arg), Chymotrypsin (site of action: carboxyl side of aromatic amino acids and amino acids with large hydrophobic residues), and Proelastase (site of action: carboxyl side of smaller, non-polar amino acids). Specific exopeptidases include: Carboxypeptidase A (site of action: terminal aromatic/branched chain amino acids), and Carboxypetidase B (site of action: terminal Arg/Lys). In addition to pancreatic enzymnes, there are also several membrane bound proteolytic enzymes in the intestine, including: Enterokinase (activates Trypsinogen), Aminopetidase (cleaves 1 amino acid at a time from the N-terminal), and Dipeptidase (cleaves 2 amino acids at a time from the N-terminal). Following digestion, amino acids can be absorbed as free amino acids or as di- or tri-petides. Free amino acid transport occurs through a series of amino acid transporters (y^+, $b^{o,+}$, B, $B^{o,+}$, β, imino, and X^-_{AG}). Each transporter is specific to a group of amino acids, designated by similar R-group characteristics. Most of these amino acid transporters are energy dependent, requiring the co-transport of Na. This Na-gradient is made possible by the Na-K ATPase, which pumps Na out of the cell and K in. Di- and Tri-peptides can be transported by the peptide transporter, Pept-1, which requires the co-transport of H. The inward H gradient is establish by a Na/H exchanger, which is driven by the inward Na gradient, and therefore is made possible by the Na-K ATPase. Therefore, in general it requires 1 ATP to move a free amino acid across the brush border membrane, and 1 ATP to move a di- or tri-peptide across the brush border membrane. As a result, it is more energy efficient for the body to absorb peptides than free amino acids. The concentration of peptide transporter is greatest in the upper small intestine, and then decreases. Whereas, the concentration of amino acid transporters is lowest in the upper small intestine and then increases as you move further down the GI tract.

12) Provided the following information, calculate the crude fiber content of this feed on an as-fed basis (12 pts.):

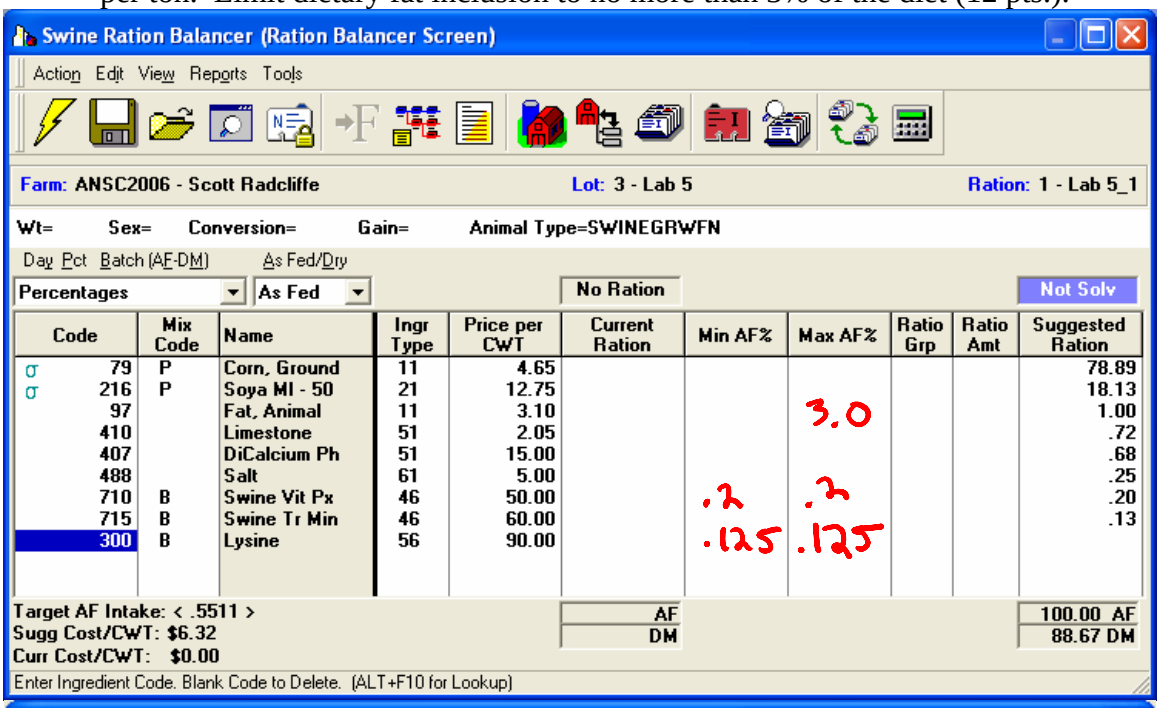
Initial sample weight = 4g
Weight after ether extraction = 3.5g
Weight after extracted sample is ashed at 600^{o}C = 3.1g

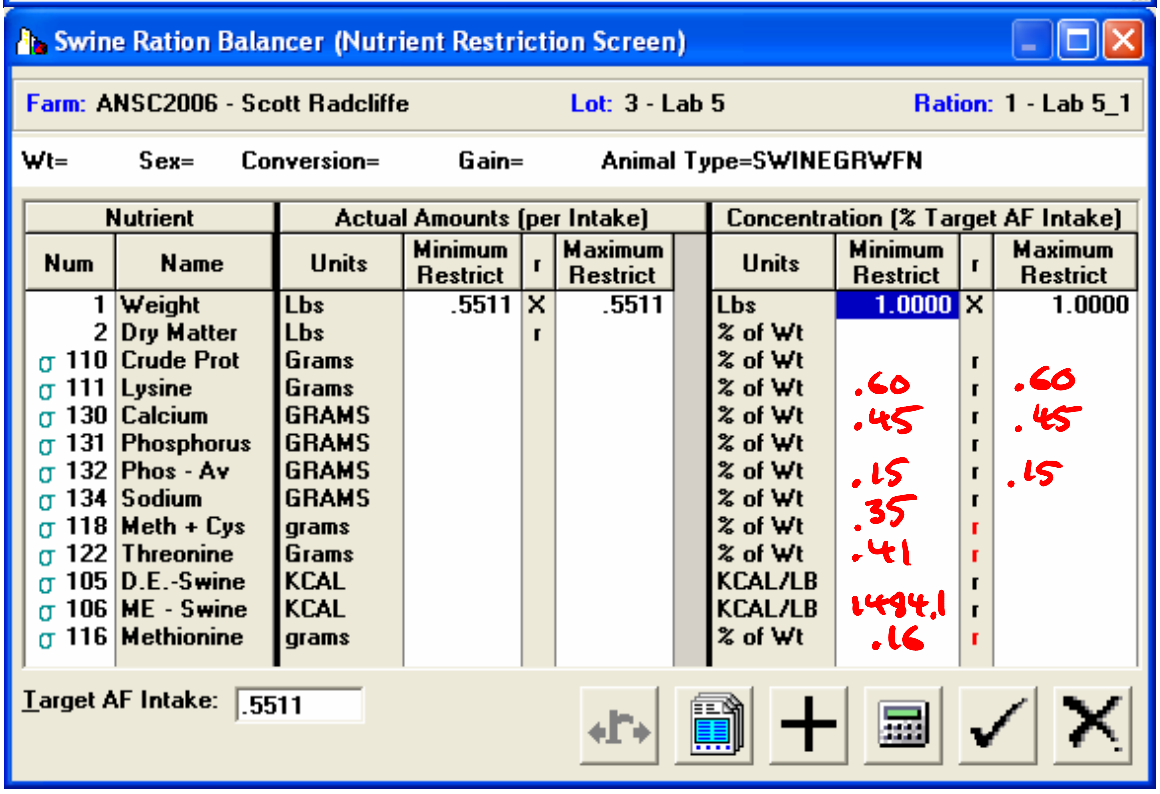
Another 1 g sample of the same feedstuff was dried for 24h at 105^{o}C. The end weight was 0.87g.

13)

$$\frac{(3.5 - 3.1)}{4} \times 100 = 10\% \text{ on as-fed}$$

Using the attached NRC table, place the proper nutrient restrictions in Brill to formulate a diet for a 185 lb pig, that meets, but does not exceed the Ca, aP, lysine, and threonine requirement. In addition, make sure that the diet meets or exceeds the requirements for ME, methionine, and total sulfur amino acids. Also, fix the vitamin premix inclusion level at 4 lb per ton, and the TM premix at 2.5 lb per ton. Limit dietary fat inclusion to no more than 3% of the diet (12 pts.).





185 / 2.5 = 84.1 kg