IISME FTP PROPOSAL

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A SPREADSHEET ON DIET AND BLOOD GLUCOSE

THIS PROJECT TAKES SOME KNOWLEDGE ABOUT BLOOD AND USING MATH AND COMPUTERS DETERMINES HOW DIET INFLUENCES TWO LIFE SUSTAINING BLOOD COMPONENTS.

TOPICS

A SPREADSHEET ON DIET AND BLOOD GLUCOSE

This project concerns human blood and some of its properties. In this project we start with some knowledge about our human blood. Then with the use of math, the computer spreadsheet program Excel, and information from internet sources, we uncover more knowledge about blood including the quantities of two biological chemicals in our blood called glucose and insulin. We estimate the amount of glucose present in our blood from typical diets that we may choose and the amount of insulin that may be necessary to sustain our everyday human life from these chosen diets.

FACTS ABOUT BLOOD

Fact-1) Your heart has one and only one purpose and that purpose is to pump blood through your body. If you did not have blood, then you would not need a heart.

Fact-2) Your lungs have one and only one purpose and that purpose is to place oxygen rich gas in your blood and remove the oxygen depleted gas from your blood. If you did not have blood, you would not need lungs.

Fact-3) Your stomach and intestines have one main purpose and that purpose is to place food and water in your blood. One of the natural chemical compounds in food that you will evaluate in this project is the carbohydrate **glucose. Glucose** appears in the blood from the large molecules of sugars and carbohydrates chemically breaking into small molecules, one of which is the sugar **glucose.**

Fact-4) Your blood is a very complex liquid. However, if you place a sample of your blood in a centrifuge (a device that spins at a high speed) and spin the blood at a rapid speed, the blood will separate into clear thin liquid called **plasma** and a red viscous liquid called **hematocrit** or red blood cells.

Fact-5) The **haematocrit** is mostly red blood cells that appear red from the iron containing **hemoglobin**. The **hemoglobin** is well known for being responsible for carrying oxygen to the cells. The clear part of your blood the **plasma**, however, is responsible for carrying everything else including water and nutrients to the cells. One important nutrient is the sugar **glucose**. **Glucose** is responsible for providing energy in the cells when **glucose** chemically breaks down in the cell.

Fact-6) One problem. When the cells throughout your body attempt to use glucose they need a very special chemical called **insulin**. Without the hormone **insulin** cells cannot receive **glucose**. **Glucose** is an indispensable nutrient required by all cells. When too much **insulin** is placed in your blood stream, too much **glucose** enters the cells. When too little or no **insulin** enters your blood stream, the cells have no way of receiving **glucose**. When cells are not able to use **glucose**, the **glucose** accumulates in the blood stream. The result is cells and the human body not function properly. Either way, too much or too little **glucose**, humans (and other animals as well) cannot properly sustain

life. Determining and controlling the amount of **glucose** in the blood stream is critical to all human beings. If or when our body cannot produce the **insulin** to control the amount of **glucose** in our blood stream, other ways are found and used to provide the insulin necessary to control this very important nutrient.

Eighteen million children, teenagers, and adults in the United States or one out of every 12 human beings in the United States are forced to bring the **insulin** to their blood from outside in order to control the **glucose** level in their blood stream.

A MATH ORIENTED DISCOVERY OF FACTS ABOUT GLUCOSE IN OUR BODY USING THE EXCEL SPREADSHEET

IMPORTANT TERMS

WORD	SYMBOL	WORD MEANING
Whole Blood	**WB**	Blood as we observe it.
Plasma	**PL**	Clear part of the blood when blood is separated.
Hematocrit	**HMT**	Red-blood-cell-containing-part when blood is separated
Glucose	**GL**	The simple sugar from carbohydrates and other food sources that is used by all cells.
Whole Blood Glucose .	**WBG**	Amount of glucose in whole blood in units of mg/dL
Plasma Glucose	**PLG**	Amount of glucose in plasma in units of mg/dL
Percent Hematocrit	**%HMT**	Percent red blood cells in whole blood (usually about 42%)

EXCEL SPREAD SHEET FOR CALCULATING AND DETERMINING PROPERTIES OF YOUR BLOOD

The figure of the Excel spreadsheet identifies some important components of the Excel spreadsheet used in our efforts in this project. You may very well be familiar with these components.


Excel Demo

(5 points: Drawing of spreadsheet)
Click on the following Excel Demo:
Draw the Excel spreadsheet labeling 1) 3 cells, 2) The formula bar (next to the equal sign), 3) A formula displayed at the formula bar and in a cell.

CELL A1

DAY ONE: SOME PRACTICE MOVES

1) Click on start, programs, and Excel.
2) Click on a new Excel spreadsheet
3) Label and save as "practice sheet-1"
4) Click on any cell
5) Add your age plus 10 to the cell.
6) Click on a different cell.
7) Add your age plus 20 to the cell.
8) Delete both numbers and click on cell A1.
9) In cell A1 type your first name.
10) In cells A2, A3, A4 click and type three other names (all in column A).
11) Click on cell B1 and type your age.
12) In cells B2, B3, B4 click on each and type ages that correspond to the names.
13) Click on cell B5 and type the following: "= (A1+A2 +A3+A4)" Note that you are typing the equal sign followed by the parenthesis.
14) What should appear in cell B5 is the sum of the numbers in A1, A2, A3, and A4.
15) If A1 equals 15, A2 equals 16, A3 equals 14, and A4 equals 15, then the quantity in B5 should be 60.
16) Click on cell B6 and type the following: "= (A1+A2+A3)/A4"
17) Add the values in A1, A2, and A3 and divide by the value inA4. See if the number in B6 is correct or between 2.5 and 3.5.
18) Click on cell B7, type the following: "=A1/A5*100
19) This last calculation is A1 as a percent of the four numbers or about 25.
20) Repeat the formula in B7 and find A2, A3, and A4 as a percent of the four numbers.

The above are some basic operations each of which probably has a simpler and faster method of achieving. If you have knowledge of Excel then you may know some or all of these simpler methods.

(For 30 points if your efforts above and the following are successful)

One more exercise: Copying formulas:

1) Click on and type numbers 10, 20, 30, and 40 in cells C1, C2, C3, and C4 in the same order.
2) Click on B5 and click copy on tool bar.
3) Click on C5 and click on paste.
4) After hitting Enter or clicking on another cell, the number in C5 should be 100.
5) You transferred the formula from B5 to C5 which can be achieved by clicking and dragging at the corner of B5 to C5.

6) Transfer the formula in B6 to C6 and B7 to C7 by: (one at a time) click on B6, "click copy", click on C6, then click on paste. The value in C6 should be 1.5. Repeat for B7 and C7. The value in C7 should be 10 (or 10%).

You have copied formulas used for data in column B to complete the calculations for data in column C. These steps of repeating formulas will be used later in our spreadsheet.

DAY TWO: USEFUL WEBSITES

The following websites contain useful data and formulas.

1) http://library.thinkquest.org/J002616F/diabetes.htm (Grams of carbohydrate per unit of insulin.)
2) http://www.childrenwithdiabetes.com/clinic/menu/menu02.htm#top (Carbohydrate counter)
3) http://www.childrenwithdiabetes.com/dteam/2001-11/d_0d_7vv.htm (Ratio of Carbohydrates to insulin.)

(10 points: Writing a summary)

Write a one sentence summary for each website that describes the topic covered in each website.

BUILDING AN EXCEL SPREADSHEET THAT TAKES THE AMOUNT OF CARBOHYDRATES THAT YOU AND YOUR FRIENDS EAT, CALCULATES GLUCOSE IN YOUR BLOOD STREAM, AND CALCULATES THE AMOUNT OF INSULIN REQUIRED TO MOVE THE GLUCOSE INTO THE CELLS OF YOUR BODY

The following sets up your spreadsheet with a column for your name and your friend's names and columns for the grams of carbohydrates for each serving of a food items for a typical lunch or other meal:

1) Click on programs, click on Microsoft Office, then click on Excel.
2) Label and save your spreadsheet as "DIET_GLUCOSE_INSULIN_SPREADSHEET"
3) Click on cell A1, and type in capital letters: NAME
4) Click on cell C1 and type: FOOD #1
5) Click on cell D1 and type: FOOD #2
6) Click on cell E1 and type: FOOD #3
7) Click on cell F1 and type: FOOD #4
8) Click on cell G1 and type: FOOD #5
9) Click on cell H1 and type: FOOD #6


SPREADSHEET

How are these labeled cells to be us?
If for example you ate a piece of cake that contained 300 grams of carbohydrates, 300 would be placed in column under "FOOD #1 in the row with your name. Remember: columns: up/down, rows: left to right. We will use one or more web sites to find the grams of carbohydrates. Click on the SPREADSHEET icon to view worksheet.

We need to set up our spreadsheet with columns for total weight of carbohydrates, the amount of glucose that will show up in the bloodstream, and the amount of insulin required to process this glucose:

10) Click on cell I1 and type: TOTAL CARBS

11) Click on cell J1 and type: GLUCOSE (mg/dL)
12) Click on cell K1 and type: INSULIN (units)

What is the meaning behind these units for **glucose and insulin** ?
We will use the power of Excel to find total carbohydrates. (Remember the practice spreadsheet exercises!). We will use web sites to find equations for determining the number of milligrams (mg) of **glucose** in each deciliter (dL) of blood in your bloodstream. Finally, we will use a web site to determine how to calculate the units of **insulin** needed. Note: the measurement units: "mg/dL" (for **glucose** concentration in the blood) and "units" (for amount of **insulin**) are standard units of measure that are familiar to any person who needs to know how much **glucose** is in their blood or someone else's blood.

Entering equations in spreadsheet for calculating total carbohydrates, glucose concentration, and insulin required:

13) Click on cell B2 and type your first and last name.
14) Find the website number 2 above and review the web site.
15) Learn how to find the amount of carbohydrates in grams for a 4-course lunch consisting of a hamburger, fries, an apple, and a soft drink.
16) Write this lunch on a separate sheet of paper as a table with the carbohydrates listed separately for each item. This table will help you keep track of what you find in the website. The accuracy and appearance will be part of the grade.
17) Click on B2 and type the meal number which is meal number one for you.
18) Click on cells C2, D2, E2, and F2 and type in each cell grams of carbohydrates corresponding to that for hamburger, fries, apple, and soft drink.
19) Click on cell I2 and type the formula for the total carbohydrates for the lunch: "=C2+D2+E2+F2.

20) After clicking on cell J2, does the numbering in cell I2 equal the total carbohydrates for the lunch?
21) Look at the Formula Bar. (The area next to the equal sign "=" above) Does the correct formula appear in the Formula Bar? Change the formula at the Formula Bar if the number in I2 is incorrect or does not appear.
22) Find the websites numbers 1 and 3 above and review both websites.
23) Determine the number of milligrams of glucose in each deciliter of blood after eating a certain number of grams of carbohydrates. This ratio will be a typical value that will be useful to us.

Why are we using these websites to find a ratio?
Companies like LifeScan in Milpitas, California manufacture **glucose** meters that are used by individuals who must know their **glucose** level in order to remain healthy and live a long life. These individuals take samples of blood from their fingertips or other places and using the meter find their **glucose**
concentration in mg/dL after eating a quantity of **carbohydrates**. We are not going to remove and test our blood, although you may know someone who routinely tests his or her blood. We will use the websites to arrive at a ratio of mg/dL of **glucose** in our blood after eating a number of grams of **carbohydrates**.
We will use this ratio for all the dietary **carbohydrates** we list in our spreadsheet.

24) Click on J2 and type the formula: "=I2*(ratio of **glucose** (mg/dL) / grams of **carbohydrates**). This ratio will be typed, for example, 23/57 or 10/ 15.
25) Click on K2 and determine if the number is correct in cell J2. Look at the formula bar to see if the equation is correct. You should have the total milligrams of **glucose** for each deciliter of blood for the number of grams of **carbohydrates** in the lunch.
26) Using websites 1 and 3, determine a ratio of the units of **insulin** required for a concentration of **glucose** in mg/dL. You do not have to reduce this ratio.

Why is this ratio of **insulin** to **glucose** important?
As was stated earlier, everybody needs **insulin** in order to survive, whether they make **insulin** in their pancreas or get the **insulin** from some outside source. In nature, the human body must determine the ratio of the amount of **insulin** needed to the amount of **glucose** present (and place the necessary amount of **insulin** in the bloodstream). If the human body cannot accomplish this task then a sample of blood must be taken from a fingertip and using a **glucose** meter or some other medical testing device, the ratio of **insulin** to **glucose** present in the bloodstream is determined.

We also need to know this ratio of **insulin** needed to the amount of **glucose** present in the bloodstream. and we are using the websites to estimate the ratio of units of **insulin** to mg/dL of **glucose.**

27) Click on cell K2 and type the formula for the units of **insulin**: "=J2*(ratio of units of **insulin** to mg/dL of **glucose**)" As with the previous formula, this ratio will be, for example, 4/8 or some other fraction.

(30 points for a completed spreadsheet that achieves the correct units of insulin in the next two paragraphs)

For this 4-course lunch, you should arrive at a quantity of **insulin** of 47 units in cell K2. If this value is not correct, check your formulas, calculations, and values in grams for each of the four items on the menu.

28) Write in your table of meals, the following meal: salad, soup, vegetarian sandwich, a class of milk, and a banana. Type in the grams of carbohydrates for the 5 items, and copy, click, drag to determine the total amount of carbohydrates in grams, the mg/dL of glucose that will end up in the blood, and the units of insulin needed.

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(40 Points): FOUR 6-COURSE MEALS THAT ARE CONSIDERED "HEALTHY"

29)Find four other students, friends, or relatives and let them prepare each a 6 course meal. Using the website 2, find the amount of carbohydrates in grams for each course and place the data in the spreadsheet. insulin for each meal
30) After entering the name, grams of carbohydrates for each food item, click copy and drag to copy the formulas in order to use the spreadsheet to calculate the total carbohydrates in column I, mg/dL of glucose in column J, and units of insulin in column K.
31) prepare a table on paper that includes the person, each item in the meal and the corresponding grams of carbohydrates. (You will have completed two tables on paper that include the practice meals and the four 6-course-meals.

GRADING RUBRIC

1) Drawing of spreadsheet: 5 points
2) Correct practice moves: 30 points
3) Writing website summaries: 10 points
4) Correct completed spreadsheet with accurate formulas: 30 points
5) Four 6-course meals correctly entered: 40 points
6) Written Table with names, menu, and grams of carbohydrates: 25 points