Jenova

Genetic Probability and Chance

AiS Challenge

Final Report

2003

Team 045

Manzano High School

aisc.whiteorbmedia.com

Executive Summary:

The purpose of the project is to predict the genes of certain traits in humans. We hope to include fine details, including ethnicity. We are planning to use Mendelian genetics and Punnett squares. We intend to use C++ and possibly some assembly for math; doing so we wish to have the final project in the form of a Graphical User Interface (GUI.) From the beginning, however, we intend to start with just the eyes and hair color.

Background:

History:

Genetics have been a recurring subject for many centuries. Whether it was trying to estimate the sex of a child based off of parental age and the direction of the wind; or it was the study of DNA. A highly discussed topic, recently, has been about cloning. However, in cloning there is a much deeper subject, setting the genetic probability. The concept of cloning is based around setting the DNA to create, or 'recreate', a set specimen. This concept can be taken and used to a lesser idea: Not recreating a specimen, but altering DNA or Chromosomes to create a child. This ability would allow the parents to 'Design a child' of their choice. This scientifically beautiful idea, can cause many problems. For example: If government facilities chose to create soldiers, in this case Humans would be grown and raised like machines. This fear is one of many preventing the carrying out of cloning. Religion also plays a large role in preventing cloning.

Genetics is a vast subject, being the root of all living beings. This includes not only all animals, but vegetation. One of the most important genetic findings was in the middle of the 19^{th} century when Charles Darwin announced the theory of evolution, The basis of which was a specimen improving genetically to a superior state. A common example is the human race evolved from early primates. This raises another example that not all parties agree with the study of genetics, or evolution. Many religious beliefs make reference that contradicts the concept that *we* evolved from primates.

Currently Homo sapiens have forty-four and two chromosomes, twenty-two pairs of autosomes and one pair of X-chromosomes if female, one X-chromosome and one Y-chromosome if male. The single pair of chromosomes, which consists of either two X or one X and one Y is the two referred to in forty-four and two, also it is often referred to as the sex chromosomes. According to Sacred Geometry, which is non-scientific, Homo sapiens will advance to forty-six and two chromosomes, which by most means is a form of evolution. This evolved form is referred to as the "Christ Consciousness." This being a religious term making reference to a religious figure *and* evolution somewhat disgraces the argument that there is no Evolution. This again goes back as far as the argument that the study of evolution is against religious beliefs; which has been ongoing and recurring since the beginning of the study of evolution, or genetics in whole. Genetics, by name or not, are a large part of society and existence. Even if many disagree with the concept of using genetics to alter an unborn child to further the research and advancing the knowledge on the subject is an important part of the present and the future.

Mendel's research also made a great advancement on the study of genetics. Mendel started with a garden pea plant, Pisum, he chose this because they could be conditioned so that they could manually be pollinated. This would be done by hand pollinating the plants, choosing certain traits (Mendellian Traits), and making different combinations. Using the results of these tests, mathematics reason was formed.

Mathematics:

Based off of Mendel's research the best example of genetic mathematics is using Punnett Squares with peas as the Specimen. Several traits that are commonly seen in peas are:

Form of ripe seed	Smooth	Wrinkled
Color of seed albumen	Yellow	Green
Form of ripe pods	Inflated	Constricted
Color of unripe pods	Green	Yellow
Position of flowers	Axial	Terminal
Length of stem	Tall	Dwarf

Punnett squares use a simple concept. Taken the Dominant gene and the Recessive gene it forms a ratio for the possible outcome. Capital letters are Dominant and lower case letters are Recessive.

	G	**g**
G	**GG**	**Gg**
g	**GG**	**gg**

Assuming two plants are chosen with 100% of any separate given trait, for this example Smooth or Wrinkled. Being the wrinkled pea plant is 100% both factors are Dominant. This also applies to the Smooth plant. Thusly Ss will be used for the Smooth plant, and Ww for the Wrinkled.

	S	**s**
W	**SW**	**sW**
w	**Sw**	**sw**

This gives a ratio of SW:Sw:sW:sw, 1:1:1:1. Four likely possibilities, however, SW and sw are seen similary that they will be equally mixed, this narrows it down to SW:sw:sW:Sw, 2:1:1. This is a 50% of being a hybrid pea, a 25% chance of wrinkled and 25% chance of smooth. Taking two of the offspring, one Sw and one sw:

	S	**w**
s	**Ss**	**sw**
w	**Sw**	**ww**

The results in this case are Ss:sw:Sw:ww, 1:1:1:1. In one case a fully Smooth offspring is born, and one case the offspring is fully wrinkled. In another a hybrid is formed. And in the final offspring it is dominantly Smooth, however can produce wrinkled offspring with its recessive gene.

Method:

Research:

Every living thing in the world is made up of genes. A single gene is made up of DNA, which stands for deoxyribonucleic acid. DNA is a structure similar to a ladder and is composed of five parts. The “spokes” of the ladder are made of four protein bases: Guanine, Cytosine, Thymine, and Adenine. The proteins are arranged differently to create different genes. The “backbone” of the ladder is made of sugar phosphate.

There are basically two types of genes: dominant and recessive. The dominant gene “dominates” a recessive gene, so that only the dominant gene’s trait is shown. It is only when there are two recessive genes that the trait becomes apparent. For example, brown eyes are dominant over blue eyes. Therefore, if a person has the genes Bb (one brown-eye gene and one blue-eye gene), he will have brown eyes because the brown-eye gene is dominant over the blue-eye gene. If somebody had the genes bb (two blue-eye genes), that person would have blue eyes, because this is the only way the recessive blue-eye gene can be apparent.

Another aspect of Mendelian genetics is the concept of alleles. Alleles are different forms for a particular trait. Co-dominance occurs when two dominant alleles are present, resulting in a combination of the genes. One such example is hair. Brown and black hair both seem to be dominant genes. So, if a person has the genes NK (one brown-haired gene and one black-haired gene), then the person will have dark-brown hair.

The difficulty with Mendelian genetics is the prediction of the offspring’s traits. By using a Punnett square, the probability of a person having a particular trait can be calculated. Therefore, if two people who both have the genes Bb (one brown-eye gene and one blue-eye gene) have a child, the child has three-fourths of chance to have brown eyes and one-fourth of a chance to have blue eyes.

Process:

The process that was followed composed of a combination of AISC reports, the sponsor's instructions, and unplanned events. Originally, Team 45 was two groups: one studying forest fires, the other studying fractals. Both submitted an appropriate abstract at the beginning of the year. Working separately and under the direction of Mr. Schum, both teams started to learn basics that would help to develop the projects. Some of the skills learned were Unix commands, C++ basics, Web design, Adobe PhotoShop, and PowerPoint.

About the time Interim Reports were due, the original teams decided to combine because forest fires and fractals were related. The new team searched for a fractal-related, mathematical equation, but the only one available was theoretical and dealt with math that was too advanced for any of the members of the team.

As team, the project was transferred to genetic probability. The team researched extensively on Mendelian genetics and developing a program. First, a basic program was created based on Punnett Squares to randomly model genetic behavior. During this time, the team continued to expand its C++ skills. In February, the team presented this project to a group of AISC judges, who proved helpful in their comments. After the evaluation, the team has worked concurrently on the final report and further developing the program.

Results and Analysis:

The project was accurate; however, the information was limited. The project was fulfilled the goal intended in the abstract. That is, that the program was able to predict hair and eye color and a person's ethnicity. With the time given, the team realizes that it would have been better to start earlier. Also, the team would still like to improve the program by adding the probability of genetic diseases and include the ratio of people who have a certain trait.

Conclusion:

Genetics are an important part of everyone's life because they create the person through the traits inherited by the parents. Many people suffer from genetic diseases, including: alcoholism, Cystic Fibrosis, Parkinson's, and some types of cancer. Being able to predict the genes that one child will inherit will give us an estimate of diseases and hopefully a cure for them. The more that is understood about genetics, the more our ability to understand ourselves increases.

Appendix:

Acknowledgments:

Stephen Schum – Our sponsor and teacher.

Borland C++ Builder 5.0

Adobe PhotoShop 7.0.1

White Orb Media – Server space. www.whiteorbmedia.com

References:

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Goodman, Harvey D.; Graham, Lind E. Biology Today. Austin, Texas; Holt, Rinehart and Winston, Inc., 1991.

Strauss, Eric; Lisowski, Marilyn. Biology: The Web of Life. Menlo Park, California; Scott Foresman Addison Wesley, 1998.

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http://www.sonic.net/~nbs/projects/anthro201/disc/

http://www.accessexcellence.org/AE/AEPC/WWC/1994/punnett.html

Code:

```
//---------------------------------------------------------------------------
#include <vcl.h>
#pragma hdrstop
USERES("Project1.res");
USEFORM("Unit1.cpp", main);
//---------------------------------------------------------------------------
WINAPI WinMain(HINSTANCE, HINSTANCE, LPSTR, int)
{
    try
    {
        Application->Initialize();
        Application->CreateForm(__classid(Tmain), &main);
        Application->Run();
    }
    catch (Exception &exception)
    {
        Application->ShowException(&exception);
    }
    return 0;
}
//---------------------------------------------------------------------------

#include <vcl.h>
#pragma hdrstop

#include "Unit1.h"
//---------------------------------------------------------------------------
#pragma package(smart_init)
#pragma resource "*.dfm"
Tmain *main;
//---------------------------------------------------------------------------
__fastcall Tmain::Tmain(TComponent* Owner)
    : TForm(Owner)
{
```

```
}
//---------------------------------------------------------------------------

void __fastcall Tmain::Button1Click(TObject *Sender)
{
srand(time(NULL));
int eyes=(rand()%100)+1;
if (eyes < 51)
{
main->child->Text = main->mother->Text;
} else {
main->child->Text = main->father->Text;
}

}
//---------------------------------------------------------------------------

#include <iostream.h> //cout, cin, etc...
#include <stdlib.h>   //rand(), srand(), etc...
#include <time.h>     //time(), etc...

int main()
{
  int f, m;
  int c1 =1; //counter 1
  int c2 =1; //counter 2
  srand(time(NULL));
  cout << "Jenova. By Alex Booker, Brian Rosen, and Maggie Walton" //happy fun startup screen
       << endl
       << "Please enter number of father ethnicity: ";
  cin >> f;
  cout << endl;
  char f_eth[f]; //father eth. array
  while (c1 != f+1) // while c1 doesn't equal father number of eth. +1
  {
    cout << "Please enter father ethnicity ";
      cout << c1;
      cout << " :";
      cin >> f_eth[c1];
      cout << endl;
      c1++; //increment counter 1
  }
  cout << "Please enter number of mother ethnicity: ";
  cin >> m;
  cout << endl;
  char m_eth[m];
  while (c2 != m+1)
```

```
    {
       cout << "Please enter mother ethnicity ";
       cout << c2;
       cout << " :";
       cin >> m_eth[c2];
       cout << endl;
       c2++;
    }
    int frand=(rand()%f)+1; //rand # between 1 and the value of 'f'
    int mrand=(rand()%m)+1;
    cout << "The child might be " << f_eth[frand] << "/" << m_eth[mrand] << endl //final output
       << "Thanks for using Jenova."; //goodbye!
    return 0;
} // ^_^
```

Note:

Our project is being written in Borland C++ Builder 5 using a GUI (Graphical User Interface.) Because of this, the code is not exported into text form very well. Above is a sample of the code before it was implemented into the GUI. Also, is a piece of the code for GUI for calculating eye color.