Future of New Mexico

Human Sciences

New Mexico High School
Supercomputing Challenge
Final Report
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Executive Summary

Have you ever wondered what the future would be like? Whether there would be a colonization of Mars, or if a Utopian society were to be created. In "The Future of New Mexico," the goal was to see what our population would look like in 5,10, or any number of years. This data could be used by a vast number of different resources. The government uses the census bureau to create projections just as have been done here. Also many industrial leaders could use the information generated to decide whether or not to bring their large corporations here to meet a growing work force. This information could also help people decide when to sell off something, or to wait for a greater profit from the ability to sell to more amounts of people. This could even help the New Mexico government prepare to accommodate for changes in population throughout the years.

The aim of this project was to be able to accurately predict the future of this great state, New Mexico. In the beginning, web research was done on census data. The data included past censuses for trending, current population reports on births, deaths migration, etc, and even looks at others future population estimates. Soon afterwards it was deemed necessary to write a C++ program to estimate the population over a user-defined number of years. After a control program was built, variables were added that would affect the population such as: drought, tornado, an atomic bomb, baby boom, and small pox.

The results from the program resulted in educated conclusions from the entire group. It was found that 67% of the time, no variables came into effect over the outcome of the population projection. Though, when the computer randomly inserted the variables it was found that emigration had a 6% chance of occurring over the next ten years. This happened because immigration was programmed to occur more often than any other variable, besides for drought and a tornado.

These results led the group to conclude that the population of New Mexico can be accurately predicted through a simple C++ program.

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Problem:

The aim of the project is to predict the population of New Mexico in the future through the use of a control program. When the program has figured the population to a given year; some variables will be added. These variables may include: small pox, baby boom, fire, tourism, massive flooding, etc. Good and bad variables will be added in equal amounts to more accurately predict our future.

Methodology:

The methodology used in this project in order to build the program were math models from the US Census and the UNM Databank in Albuquerque. It required at least two different models in order to more accurately estimate the population in the future. In the beginning the program only used one model for the control program. Then as the program grew more complex, it was soon found necessary that a second math model was required in order for the results to be checked against each other. The two math models are in appendix C.

The first model was the model the US government uses in their calculations for each state. After each model was inserted into the program, and the program gave us the population after a given number of years, the program was revamped to include the use of defaults, random variables. The program had to almost be entirely rebuilt because some of the math on the original program was faulty and caused data loops that should not have been. The difference between the two programs has proven to be around 16,000 in one math model, and 1,000 in another. The models even had to be changed. A look at population trending has shown that over the past 100 years; every 40 years there is a

population slump where New Mexico fails to grow but a few thousand people. This had to be included into the program for the same reason as the added math model. The variables inserted into the program were random, and based upon the systems current time.

Results

This population growth program is very unique, compared to most programs, due to the fact that we have integrated random variables. Most simple programs keep a consistent growth rate to allow for one specific answer, but the real world is not like that. Due to the fact that we are required to have a result, using our control program, the population of New Mexico, assuming nothing changes the growth rate, will be between 1,847,788 and 1,840,502. We have established, for the control project, that the growth rate per year is .092%. There are billions of variables in the world that factor into different rates of growth. Some of the variables that were used in our random variable program were baby booms, smallpox, fire, and drought.

Conclusions

This group hypothesized that the population of New Mexico will grow by about .5% per year. This hypothesis was proved incorrect, for the program built showed that New Mexico will growing by approximately.092% per year if the birth and death rates remain the same. Currently the population of New Mexico is 1,829,146. But in 10 years the population is predicted grow by roughly 20,000 people. This data shows that it is possible to predict the future population using a simple C++ program with randomly inserted variables.

A:
Program Code

```
/*****************************
*        Population Program          *
*          BY: Team 39               *
*****************************/

#include <iostream.h>

#include <stdlib.h>

#include <ctime>




void rand_var();

float ret_p();
void prog();

int r;


main()
{
   char ans;
   std::srand(time(0));
   do
   {
    r=(std::rand() %50);
    prog();
    cout<<"again? (y/n)"<<endl;
    cin>>ans;
   }
   while (ans!='n');
   return(0);
}

void rand_var()
{
  if (r>=16)
   cout<<"Nothing Happens to New Mexico."<<endl;
  else if(r<=1)
```

```
   cout<<"Thousands immigrate to New Mexico"<<endl;
  else if (r==2)
   cout<<"Parents in New Mexico create a state-wide baby boom."<<endl;
  else if(r==3)
   cout<<"State Universities become the choice of hundreds."<<endl;
  else if (r==4 || r==5)
   cout<<"Terrorists reintroduce smallpox, an epidemic ensues."<<endl;
  else if (r==6 || r==7)
   cout<<"Drought engulfs the state, a second Dust Bowl ensues."<<endl;
  else if (r==8 || r==9 || r==10)
   cout<<"A tornado hits eastern New Mexico."<<endl;
  else if (r==11)
   cout<<"A fire destroys Albuquerque."<<endl;
  else if (r==12)
   cout<<"Famine caused by drought hits New Mexico."<<endl;
  else if (r==13 || r==14)
   cout<<"Massive layoffs cause a wave of emigration in search of work."<<endl;
  else if (r==15)
   cout<<"\a Atomic bomb blasts New Mexico into the stone age."<<endl;
}
float ret_p()
{
  float p;
  if (r>=16)
   p=0;
  else if(r<=1)
   p=.10;
  else if (r==2)
   p=.25;
  else if (r==3)
   p=.05;
  else if (r==4 || r==5)
   p=-.4;
  else if (r==6 || r==7)
   p=-.45;
  else if (r==8 || r==9 || r==10)
   p=-.08;
  else if (r==11)
   p=-.15;
  else if (r==12)
   p=-.09;
  else if (r==13 || r==14)
   p=-.15;
  else if (r==15)
   p=-.8;
  return p;
}
 void prog(void)
{
```

```
   float change=0,pct=0,pcts=0,b,d,nim,ndm,ni,bob,
   yr=0,yrs=5,pop,pn,pa,popa,inc=0;
   char def,con;
   cout<<"Welcome to the Future of New Mexico"<<endl;
   cout<<"Would you like to use the control program? (y/n)"<<endl;
   cin>>con;
   cout<<"Would you like to use the defaults? (y/n)"<<endl;
   cin>>def;

   if (con=='y')
    r=16;

 //if-then for defaults

   if (def=='n')
   {
   cout << "Please enter the births from the past 10 years."<<endl;
   cin>>b;
   cout << "Enter the deaths from the past 10 years."<<endl;
   cin  >> d;
   cout << "Please enter the population for New Mexico."<<endl;
   cin  >> pop;
   cout<<"Enter the net international migration."<<endl;
   cin>>nim;
   cout<<"please enter the net domestic migration."<<endl;
   cin>>ndm;
   cout<<"For how many years would you like the program to run"<<endl;
   cin>>yrs;
   }
   else
   {
   b=33732;
   d=16862;
   pop=1829146;
   nim=5935;
   ndm=-12481;
   yrs=10;
   inc=3;
   }

 //b+d will make natural increase(change)

   pa= ret_p();
   b/=10;
   d/=10;
   nim/=10;
   ndm/=10;
   change = b - d;
 // ((b-d+nim+ndm)*n)+p=pn
```

```
   ni=nim+ndm;
   bob=change+ni;
   pct = change/pop;
   pcts=pct*100;
   popa=pop;
   cout << "The Percent growth in 1 year is \n"
        << pcts << "%. \n"
        << "If the birth rate doesn't change, \n"
        << "we will be able to estimate the population of the future.\n"<< endl;
   rand_var();
//loop to be able to run the program for any time needed.
          for (yr=0;yr<=yrs;yr++)
        {
         pn=bob+popa;
                    popa=pn;
                    pop=pop*(1+pct);
                    pop=pop*(1+pa);
                    popa=popa*(1+pa);
                    inc++;
                    if (inc==4)
                    inc=0;
        }

cout<<"In "<<yrs<<" year(s), the population will be "<<(long)pop<<endl;
cout<<"Or in "<<yrs<<" year(s), the population could be "<<(long)popa<<endl;
   return;
}
```

B:
Output

Welcome to the Future of New Mexico

Would you like to use the control program? (y/n)

Y

Would you like to use the defaults? (y/n)

Y

The Percent growth in 1 year is 0.0922288%.

If the birth rate doesn't change, we will be able to estimate the population of the future.

Nothing Happens to New Mexico.

In 10 year(s), the population will be 1847788.

Or in 10 year(s), the population could be 1840502.

again? (y/n)

Appendix C:

Math Models

((b-d+nim+ndm)*n)+p=pn;

Where:

b = births;

d = deaths;

nim = net international migration;

ndm = net domestic migration;

n = the years for which the program will run;

p = starting population;

pn = the population after n years.

(1+(b-d)/p))*p=pn;

where:

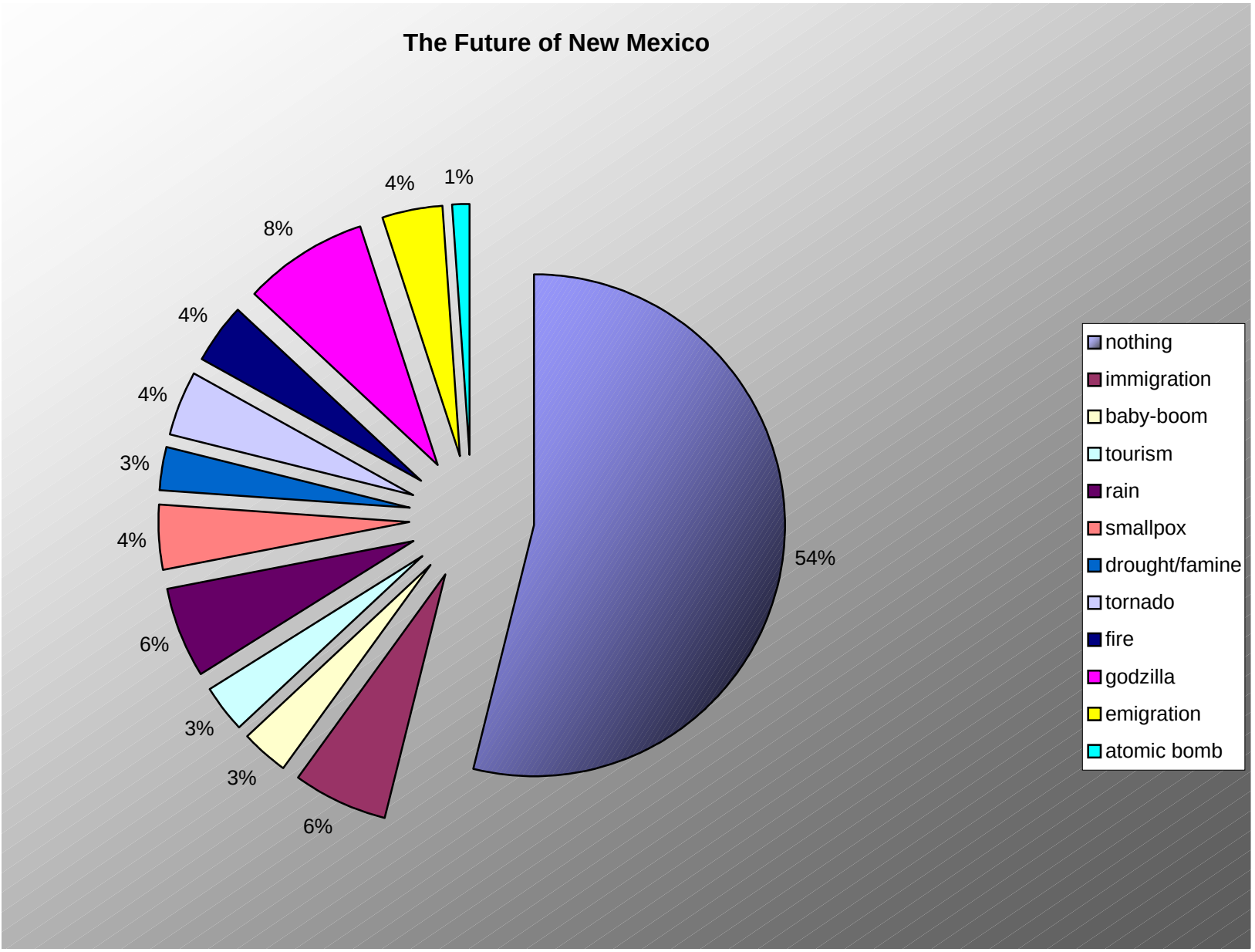
b = births;

d = deaths;

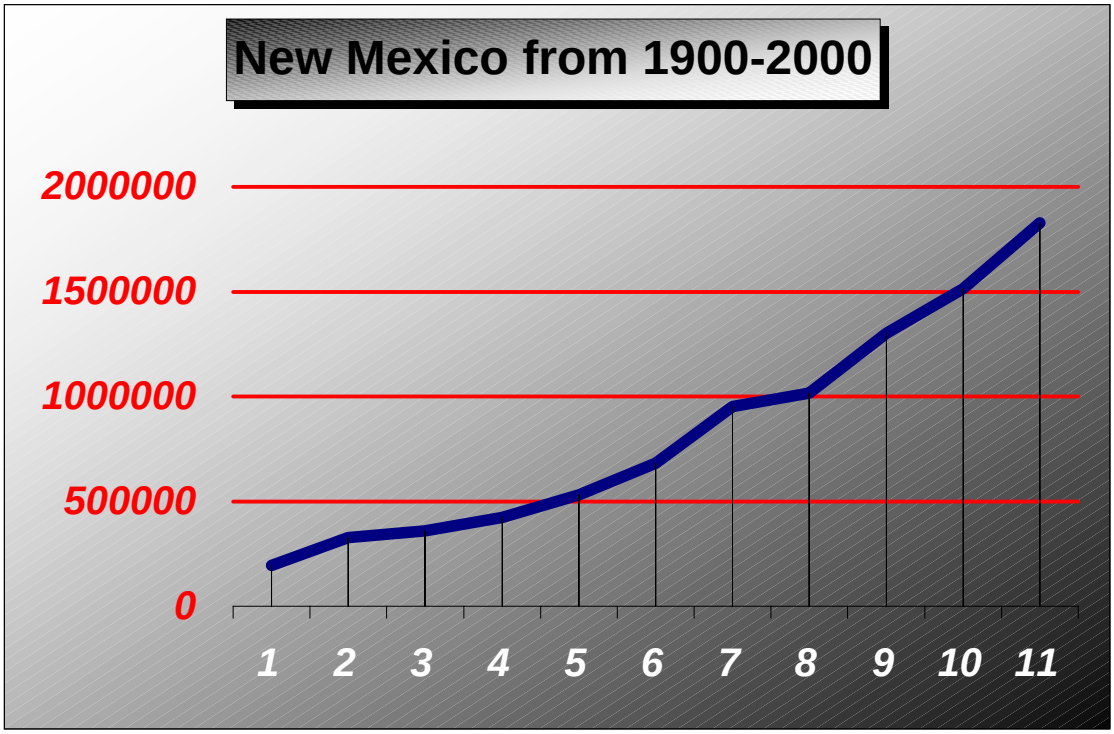
p = starting population;

pn = population after 1 year.

D:
Variable Percentage Occurrences



E:
Population Trending



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