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# *Hammurabi: Table Of Contents*

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## Introduction

The game Hammurabi, alternatively known as The Sumer Game, originated in 1968 as a text based computer game. Hammurabi focuses on the aspect of proper resource management, or conversely dealing with the consequences when there is a lack of management, and dealing with unexpected events provided by the game environment. The game is a single player game and requires strategy to end the game with higher standings than when the game began.

## Game Rules

- 1.) The game lasts 10 years, with a year being one turn.
- 2.) Each year, enter how many bushels of grain to allocate to buying (or selling) acres of land, feeding your population, and planting crops for the next year.
- 3.) Each person needs 20 bushels of grain each year to live and can till at most 10 acres of land.
- 4.) Each acre of land requires one bushel of grain to plant seeds.
- 5.) The price of each acre of land fluctuates from 17 bushels per acre to 26 bushels.
- 6.) If the conditions in your country ever become bad enough, the people will overthrow you and you won't finish your 10-year term.
- 7.) If you make it to the 11th year, your rule will be evaluated and you'll be ranked against great figures in history.

## Game Objectives

The objective of the game is to rule your land as the Babylonian king Hammurabi. Leave your land in a better condition than when you started at the end of the 10-year term the game lasts. Feed all of your people and attempt to purchase excess land to increase your holdings under your rule. Plant all your crops when to increase your yield to have the most favorable conditions and beware of the rats.

## Pseudocode

Opening comments

System Libraries

User Libraries

Global constants

Function prototypes

Begin Main Function

- Set Random Seed

- Define Constants and Variables

- Do the following

  - Call Display title function

    - Define variables and file objects

    - Open title file

    - Read title to file

    - Close file

    - Open input file

    - Read input file as title

    - Close title file

    - End line

```
    End Display title function
Call Display Rules Function
    Define Variables
    Output options to see rules or not
    If chose to see rules display rules and press enter to play,
    End line and end see rules function
Declare and initialize all the variables
Call function to display the year's data
    Output the yearly data
    End display data
For all the years the game is played do the following
    Output question one
    Input answer
    Validate answer
    Update and display decision making info
    Output next question
    Read in answer
    Validate answer
    Fill array ttlFed sub year minus 2
    Update and output decision making info
    Call first loss function
        Declare variable to hold starved people
        If the food amount fed is not enough
            Calculate how many people died
        Else starved people equals zero
        Return starved people
    Fill array deadYr sub 0 sub year minus 2 with year minus 1
    Fill array deadYr sub 1 sub year minus 2 starved people
    Output question three
    Read in and validate answer
    Update variable values for the next iteration
    If more than 45% died end the game and move to switch menu
    Call land price function
        Set random seed
```

```
        Get random land price
        Return land price
    End land price function
Call new population function
    Set random seed
    Get random new population
    Return population
    End new population function
Call crops per acre function
    Set random seed
    Get random new crops
    Return random crop value
    End function
Call second loss function
    Set random seed
    Get possibility of getting rats
    If possibility is two then rats take up to 50% of the food
    Else no food eaten by rats
    Return eaten
    End rat food function
    Process more data for the next round
    Fill rats vector sub year minus 2 with ratFood
    Declare plague
    If plague equals preset value
        Take plague deaths out of population
        Output message about plague deaths
    Call function to display the year's data
        Output the yearly data
        End display data
    For Loop ends or reiterates
If you finish with no land you lose
Else if you finish without killing everybody then you survived and output victory
message
    Output final statistics
```

```
Ternary operator for deciding if stats are good enough to be compared
with great leaders or not

Call stats function
    Declare variables to hold totals and highest values
    For loop from i=0 to i<2
        For loop from j=0 to j<10
            Output the two dimensional array for how many died each year
            If I is 0 then output the literal "dead: "
        Define variables for sorting
        Do
            Set swap variable to false
            For loop to sort the deadYr array to find the most killed in one year
        While swap is true
        For loop to calculate total of people fed
        For loop to calculate the total grains grown
        For loop to calculate how much was eaten by rats
        Output the highest killed, total grains eaten, and total eaten by rats
    End stats function

Asks user if they want to play again or quit
Input answer
If answer invalid
    Say answer is invalid and prompt another input
    If answer is invalid again
        Specify the answer type asked for
Switch base on answer received
    Case 1 display replay the game. Break away from switch
    Case 2 display game ending and end line
End do. While answer for play again does not indicate quit

End main
```

# Program

```
/*
 * File:  main.cpp
 * Author: Sebastian Hall
 * Created on July 17, 2017, 11:37 PM
 * Purpose: Final Project - Hammurabi Strategy Game
 */

//System Libraries
#include <iostream> //Input - Output Library
#include <ctime>    //For Time Function
#include <cstdlib>  //For Rand and Srand
#include <fstream> //For File Input/Output
#include <iomanip>  //Formatting
#include <cmath>   //For the math functions
#include <vector>  //For vector requirement
using namespace std; //Name-space under which system libraries exist

//User Libraries

//Global Constants
short const ENDYR=11; //The year constant for arrays

//Function Prototypes
void gtTitle(); //Output title using file input/output
void seeRule(); //Letting the player see the rules of the game
void dspYear(int &,float ,int ,float &,int &,int &,int ,int ,int); //Display
//the status for the current year
short priceL(); //New price each year
short neoPop(); //The new population each year
short cropRnd(); //Random crop growth each year
short loss(int); //Bushels lost by rats //Functions Overloading
int loss(float ,int); //People lost by starvation
void stats(int [][][ENDYR],int [],int [],vector<int>); //To output stats

//Execution begins here
int main() {
    //Setting random seed
    srand(static_cast<unsigned int>(time(0)));

    //Define menu choice variable
    short plyAg; //Play Again?
```

```
//Do while to loop for replays
do{

//Display The Title
getTitle();
cout<<endl;

//Optional Rules To See
seeRule();

//Declare and initialize variables
static int year=1;//The first year
float newPpl=0;//New people to be determined by random
int strvd=0;//The number of people you failed to feed and killed
float pop=100;//The city population. Starts at 100
int acres=1000;//City starts with 1000 acres
int totBush=2800;//Total bushels starting at 2800
int crops=0;//Amount harvested each year
int ratFood=0;//The amount the rats happened to eat that year
int lndPrc=rand()%10+17;//The current going rate for land in bushels range [17,26]
short sellBuy=0;//The number of acres one wishes to sell or buy
short acrsWrk=0;//The amount of acres you decided to work
int pplFood;//People food
int perAcre=3;//Bushels per acre
int ttlGrw[ENDYR]={0,0,0,0,0,0,0,0,0,0};//Array for grown each year
int ttlFed[ENDYR]={0,0,0,0,0,0,0,0,0,0};//The total grain for people/yr
int cnt=0;//Array increment counter
int deadYr[2][ENDYR]={0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0};//dead/yr
vector<int> rats(10);//For adding up eaten by rats


//Display the first years data
dspYear(year,newPpl,strvd,pop,acres,totBush,perAcre,ratFood,lndPrc);


//Starting Loop For Years 1-11
for(year+=1;year<ENDYR;++year){
    //Displaying the output questions
    cout<<endl<<"How Many Acres Do You Wish To Buy/Sell: ";
    cin>>sellBuy;        //Acres for sale/purchase question


    while(sellBuy<0&&sellBuy<(acres*-1)||sellBuy>0&&sellBuy>totBush/lndPrc){
        cout<<"\nI Am Afraid That Amount Is Not Possible Hammurabi-Senpai\n"
            "Enter Again\n";
```



```
    cin>>sellBuy;
}    //Validates for both selling more land than you have and for
    //purchasing more land than you could afford

//Updating and displaying important values
acres+=sellBuy;
totBush-=sellBuy*IndPrc; //Printing new values to help make decisions
cout<<endl<<"New Acres:  "<<acres<<endl;
cout<<"Total Bushels:  "<<totBush<<endl;

//Next question
cout<<"How Many Grains Would You Like To Feed Your People:  ";
cin>>pplFood;    //Feeding people question & answer
while(pplFood<=0||pplFood>totBush){
    cout<<"\nThat Is Not A Possible Amount My King\n"
        "Enter Feeding Grains\n";
    cin>>pplFood;    //Answer validation
}
//Fill Total fed to people array
ttlFed[year-2]=pplFood;

//Decision making info output
totBush-=pplFood;
strvd=loss(pop,pplFood);
cout<<"\nTotal Acres:  "<<acres;
cout<<"\nTotal Bushels:  "<<totBush<<endl;
cout<<"Total Population:  "<<pop<<endl;

deadYr[0][year-2]=year-1;//Setting years of array inside main for loop
deadYr[1][year-2]=strvd;//Setting starved of array inside main for loop

//Question 3
cout<<"How Many Acres Do You Wish To Plant With Seed:  ";
cin>>acrsWrk;    //Crop growing answer
while(acrsWrk>acres||acrsWrk<0||acrsWrk>pop*100){
    cout<<"\nThat Is Not Possible, My Lord\n"
        "Enter Again\n";
    cin>>acrsWrk;    //Answer validation
    cout<<endl;
}
//Updating total bushels for next calculations
totBush-=acrsWrk;
cout<<endl<<endl<<endl<<endl;
```

```
//Next Year Data Processing
pop-=strvd;//Taking away the people who died

//Game Failure          //If number dead exceeds 45% in 1
if(strvd>=static_cast<float>(pop)*0.45){//year the game ends and loses
    year=12;//Ending for loop
}
//Continue Data Processing For Next Iteration
lndPrc=priceL();//Random land price
newPpl=neoPop();//Random new population
pop+=newPpl;//Adding new population to old population
perAcre=cropRnd();//Crops grown per acre
crops=perAcre*acrsWrk;//Total Acres worked
ttlGrw[year-2]=crops;
totBush+=crops;//Total bushels after getting crops
ratFood=loss(totBush);//Eaten by rats. takes away from totBush
totBush-=ratFood;//Supply minus amount eaten by rats
rats[year-2]=ratFood;//Rat total vector


int plague=rand()%6;    //Plague randomizer
if(plague==3){          //If plague happens
    pop=pop*(rand()%45 +51);
    pop/=100;
    cout<<"\nOh no, a violent plague occurred and killed many "
        "citizens\n";//Alerting player of tragedy
}

//Displaying recurring header for each year
dspYear(year,newPpl,strvd,pop,acres,totBush,perAcre,ratFood,lndPrc);

}

//Output for losing with no land
if(year==11&&acres<1){
    cout<<endl<<endl<<endl<<"You Are A King Without A Kingdom And A Failure"
        " Of A Man\nYou Finished With No Land And "<<pop<<" People\n"
        "\nYou Lose";
}    //Congratulations output
else if(year==11&&acres>0){
    cout<<"\n\n\nCongratulations, You Survived "
        "All Ten Years Without Failing\n"
```

```

        "Horribly And Causing Mass Genocides And Revolts\n";
        cout<<"You Ended With "<<pop<<" People And "<<acres<<" Acres.\n"
        "That Averages To About "<<acres/static_cast<float>(pop)
        <<" Acres Per Person\n\nYou Win";
        (acres/static_cast<float>(pop)>=12)?cout<<"\nYou Lead A Country Like Trump":
        cout<<"\nYou Have Not Yet Reached Trump Status";
    } //Compares you with great leaders based on score like original does

    else{//Killing too many people output
        cout<<"\nYou Have Killed "<<strvd<<" people in 1 year\n"
        "You Have Been Dethroned And Executed For Incompetence\n"
        "You Lose The Game\n";
    }
    stats(deadYr,ttlFed,ttlGrw,rats);//Calling stats function after game ends

    //Asking to play again or quit
    cout<<"\n\n1.) Play Again\n2.) Quit\n";
    cin>>plyAgn; //play again answers
    if(plyAgn>2||plyAgn<1){
        cout<<"\nInvalid Answer Input\nEnterAgain\n";
        cin>>plyAgn;//Answer validation
        if(plyAgn>9){//Nested loop
            cout<<"Enter A Single Digit Number From 1 To 2 To Proceed\n";
            cin>>plyAgn;
        }
    }
    switch(plyAgn){
        case 1:cout<<"\nGame Restarting\n\n\n";break;//Playing Again option
        case 2:cout<<"\nGame Ending\n\n\n"; //Ending Game option
    }

    }
    while(plyAgn!=2);//Replays game if choice does not equal two
    //A Sebastian Production
    return 0;
}

void gtTitle(){
    //Opening and writing to the Rules File
    ofstream title; //Input file variable name
    string ttl; //Variable used to read file info to

    title.open("title.dat"); //Opening file

    title<<"Hammurabi: A Game Of Strategy";//Reading title to file

```

```

title.close();    //Closing file

ifstream titleO;    //Input file variable
titleO.open("title.dat");    //Opening input file

while(titleO>>ttl){    //Displaying file name one string at a time
    cout<<ttl<<" ";
}
titleO.close();//Closing file
cout<<endl;
}

void seeRule(){
    char ans;    //The answer given (just to check off char)
    bool choice;    //Boolean value for the rules display choice

    cout<<"Press 0 And Enter To See The Game Rules.\nPress ";//Rules input prompt
        "1 To Continue And Play The Game\n";
    cin>>ans;    //inputting choice to see rules
    choice=ans-48; //Setting the char to the boolean

    if(choice==false){
        cout<<"You Are Hammurabi. Ruler Of This Land\n\n"
        "1.) The game will last 10 rounds each being one year\n"
        "2.) Each living person needs 20 bushels of grain per\n"//The Game Rules
        <<setw(4)<<" "<<"year and can work up to 10 acres of land annually\n"
        "3.) Each acre of land requires 1 bushel to farm on it\n"
        "4.) If you kill enough people in one year you will be\n"
        <<setw(4)<<" "<<"impeached and lose the game\n"
        "5.) Enter a negative value to sell land, positive to buy\n"
        "6.) Reach year 11 successfully to win the game\n\n";

        cout<<"Press Enter To Play\n";
        cin.ignore();    //Clear null terminator out of keyboard buffer
        cin.get();    //Enter to go to the next screen
    }
    cout<<endl<<endl;
}

void dspYear(int &year,float newPpl,int strvd,float &pop,int &acres
,int &totBush,int perAcre,int ratFood, int lndPrc=23){
    cout<<setprecision(0)<<fixed;    //Making all outputs wholenumbers
    cout<<"Hammurabi: I beg to report to you,\n"
        "In year "<<year<<endl;    //Header similar to real
    cout<<strvd<<" People starved\n";    //In game header
    cout<<newPpl<<" People came to the city\n";
}

```

```
cout<<"The city population is now "<<pop<<endl;
cout<<"The city now owns "<<acres<<" acres\n";
cout<<"You harvested "<<perAcre<<" bushels per acre\n";
cout<<"Rats ate "<<ratFood<<" bushels\n";
cout<<"You now have "<<totBush<<" grains in store\n";
cout<<"Land is trading at "<<lndPrc<<" bushels per acre\n";

}

short priceL(){
    short lndPrc=rand()%10+17;//Assigning land price to random

    return pow(lndPrc,1);//Returning land price for each round
//Just to technically use cmath . No uses of it in this program
}

short neoPop(){
    //Calculating new people each year
    short newPop=rand()%10+3;//Range [3,17]
    return newPop;//returning the amount of new people
}

short cropRnd(){
    //Calculating random crop variable each year
    short perAcre=0;//Initialize to 0
    perAcre=rand()%5+1;//Range [1,5] crops per acre

    return perAcre;//Returning bushels per acre variable
}

short loss(int totBush){
    //Calculating random possibility of rats
    short poss=0;//Start at 0
    poss=rand()%3+1;//Possibility of rats eating grain is 1/3
    short eaten=0;//The numeric amount eaten

    if(poss==1){//If poss =1 then rats will come else
        float perc;//Percentage of crops ravaged by rats
        perc=rand()%50+1;//Range of [1,50] percent
        eaten=(totBush*perc/100);
    }
    else
        eaten=0;//No rats = np food eaten
    return eaten;//send back amount eaten
}
```

```
int loss(float pop,int pplFood){
    short strvd;
    if(pplFood/20<=pop){
        strvd=pop-pplFood/20;//Calculate how many starved if inadequate food
    }
        //Is offered
    else
        strvd=0; //If enough food is given, strvd is default 0
    return strvd;//Return dead people
}
```

```
void stats(int deadYr[][11],int ttlFed [],int ttlGrw[],vector<int> rats){
    cout<<"\n\nYear: ";
    int tGrw=0;//Total grown
    int tFed=0;//Total fed
    int highest=0;
    int ratTtl=0;

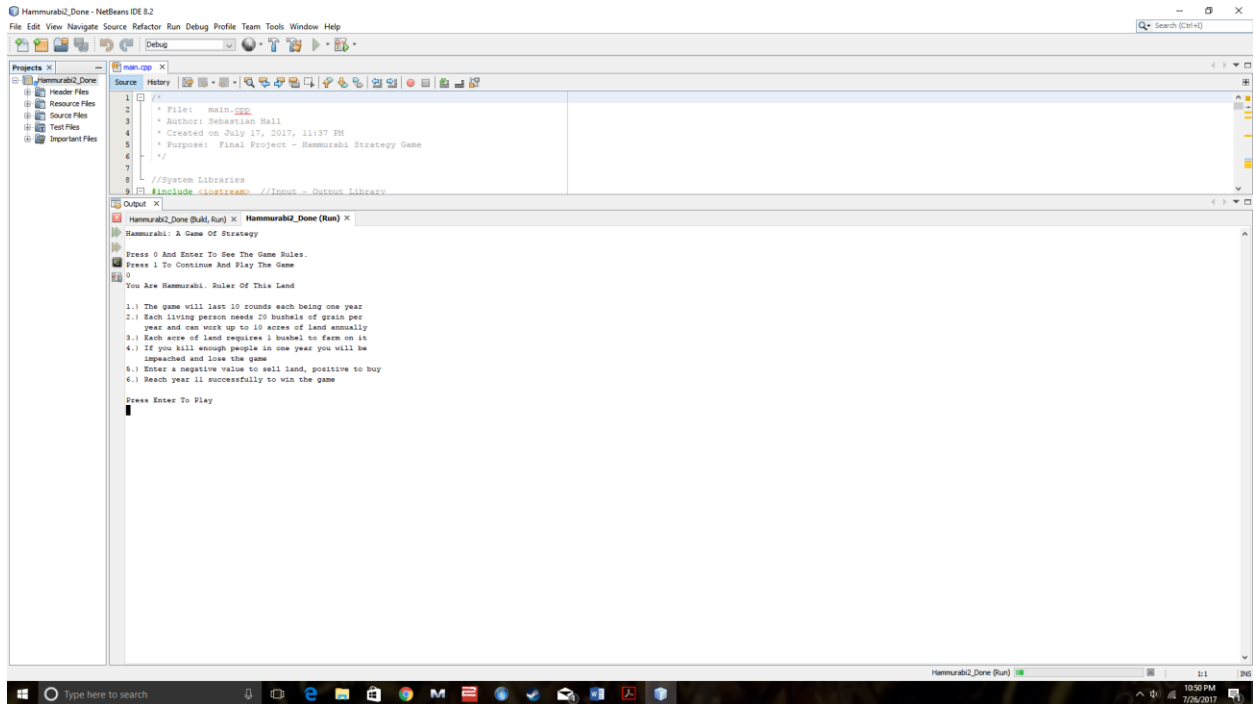
    for(int i=0;i<2;i++){
        for(int j=0;j<10;j++){
            cout<<setw(2)<<deadYr[i][j]<<" ";
        }
        if(i==0);
        cout<<endl<<"Dead: ";
    }
    //Sorting deadYr
    bool swap;
    int temp;
    do{
        swap=false;
        for(int i=0;i<2;i++){
            for(int j=0;j<ENDYR;j++){
                if(deadYr[i]>deadYr[i+1]){
                    temp=deadYr[i][j]; //Sorting before searching
                    deadYr[i][j]=deadYr[i][j+1];
                    deadYr[i][j+1]=temp;
                    swap=true;
                }
            }
        }
    }
    }while(swap);

    //Calculate totals from arrays
    for(int i=0;i<ENDYR-1;i++){
        tFed+=ttlFed[i];
    }
}
```

```
}
//Calculate totals from arrays
for(int i=0;i<ENDYR-1;i++){
    tGrw+=ttlGrw[i];
}
//Calculate totals from arrays
for(int i=0;i<ENDYR-1;i++){
    ratTtl+=rats[i];
}
//Getting high from linear search
for(int i=0;i<ENDYR-1;i++){
    if(deadYr[1][i]>highest)
        highest=deadYr[1][i];
}
//Output remaining statistics
cout<<endl<<"Highest Killed In One Year: "<<highest<<endl<<
    "Total Grains Fed: "<<tFed<<endl<<"Total Grown: "<<tGrw<<endl
    <<"Total eaten by rats: "<<ratTtl<<endl;

}
```

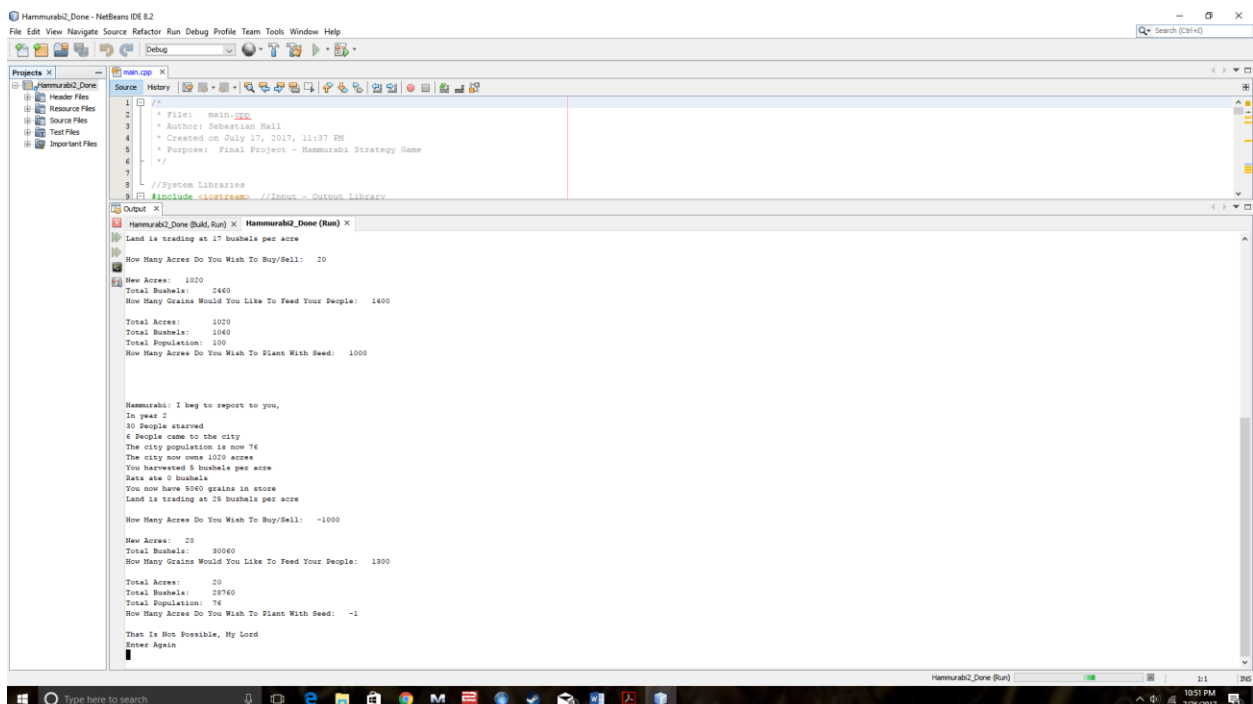
# Sample I/O



The screenshot shows the NetBeans IDE with the project 'Hammurabi2\_Done'. The source code in 'main.cpp' includes a file comment, author information, and a loop that reads user input and prints game rules. The output window shows the program's execution, including the game rules and a prompt to enter a value to win the game.

```
1 //  
2 * File: main.cpp  
3 * Author: Sebastian Hall  
4 * Created on July 17, 2017, 11:37 PM  
5 * Purpose: Final Project - Hammurabi Strategy Game  
6 */  
7  
8 //System Libraries  
9 #include <iostream> //Input - Output library
```

Output:  
Hammurabi: A Game Of Strategy.  
Press 0 And Enter To See The Game Rules.  
Press 1 To Continue And Play The Game  
0  
You Are Hammurabi, Ruler Of This Land  
1.) The game will last 10 rounds each being one year  
2.) Each living person needs 20 bushels of grain per year and can work up to 10 acres of land annually  
3.) Each acre of land requires 1 bushel to farm on it  
4.) If you kill enough people in one year you will be impeached and lose the game  
5.) Enter a negative value to sell land, positive to buy  
6.) Reach year 11 successfully to win the game  
Press Enter To Play



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6 */  
7  
8 //System Libraries  
9 #include <iostream> //Input - Output library
```

Output:  
Land is trading at 17 bushels per acre  
How Many Acres Do You Wish To Buy/Sell: 20  
New Acres: 1020  
Total Bushels: 2400  
How Many Grains Would You Like To Feed Your People: 1400  
Total Acres: 1020  
Total Bushels: 1040  
Total Population: 100  
How Many Acres Do You Wish To Plant With Seed: 1000  
Hammurabi: I beg to report to you,  
In year 2  
50 People starved  
6 People came to the city  
The city population is now 76  
The city now owns 1020 acres  
You harvested 6 bushels per acre  
You now have 5040 grains in store  
Land is trading at 28 bushels per acre  
How Many Acres Do You Wish To Buy/Sell: -1000  
New Acres: 20  
Total Bushels: 30040  
How Many Grains Would You Like To Feed Your People: 1900  
Total Acres: 20  
Total Bushels: 29760  
Total Population: 76  
How Many Acres Do You Wish To Plant With Seed: -1  
That Is Not Possible, My Lord  
Enter Again



The screenshot shows the NetBeans IDE with the project 'Hammurabi2\_Done' open. The source code is displayed in the main editor, and the output window shows the program's execution. The program is a simulation of the game 'Hammurabi'.

```
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6 */
7
8 //System Libraries
9 #include <iostream> //Input - Output Library
```

Output:

```
Hammurabi2_Done (Build, Run) X Hammurabi2_Done (Run) X
The city now owns 1000 acres
You harvested 5 bushels per acre
Rate ate 0 bushels
You now have 5040 grains in store
Land is trading at 25 bushels per acre

How Many Acres Do You Wish To Buy/Sell: -1000

New Acres: 20
Total Bushels: 5060
How Many Grains Would You Like To Feed Your People: 1300

Total Acres: 20
Total Bushels: 2970
Total Population: 76
How Many Acres Do You Wish To Plant With Seed: -1

That Is Not Possible, My Lord
Enter Again
20

Hammurabi: I beg to report to you,
In year 3
11 People starved
8 People came to the city
The city population is now 73
The city now owns 23 acres
You harvested 2 bushels per acre
Rate ate 1179 bushels
You now have 1093 grains in store
Land is trading at 18 bushels per acre

How Many Acres Do You Wish To Buy/Sell: 1000

I Am Afraid That Amount Is Not Possible Hammurabi-Bepai
Enter Again
```

The screenshot shows the NetBeans IDE with the project 'Hammurabi2\_Done' open. The source code is displayed in the main editor, and the output window shows the program's execution. The program is a simulation of the game 'Hammurabi'.

```
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6 */
7
8 //System Libraries
9 #include <iostream> //Input - Output Library
```

Output:

```
Hammurabi2_Done (Build, Run) X Hammurabi2_Done (Run) X
New Acres: 0
Total Bushels: 17801
How Many Grains Would You Like To Feed Your People: 1

Total Acres: 0
Total Bushels: 37500
Total Population: 80
How Many Acres Do You Wish To Plant With Seed: 0

Hammurabi: I beg to report to you,
In year 12
80 People starved
8 People came to the city
The city population is now 6
The city now owns 0 acres
You harvested 6 bushels per acre
Rate ate 0 bushels
You now have 17500 grains in store
Land is trading at 24 bushels per acre

You Have Killed 80 people in 1 year
You Have Been Dethroned And Executed For Incompetence
You Lose The Game

Year: 1 2 3 4 0 0 0 0 0 0
Dead: 80 11 9 80 0 0 0 0 0 0
Dead:
Highest Killed In One Year: 80
Total Grains Fed: 4101
Total Goons: 6600
Total eaten by rats: 11799

1.) Play Again
2.) Quit
```