In a Workbook called **PUNetIDHW2**, create each of the following two worksheets:

**Worksheet #1 (Name it Seals)**

While many populations grow exponentially, the exponential growth model often does not take into consideration the maximum population that a system can biologically support (the so-called **carrying capacity** of the population). Often, in practice, populations grow slowly initially before the animal is fully established, then very quickly as resources are widely available but competition is still limited, then more slowly as the population reaches the carrying capacity. A logistic growth model allows in most situations for a much more realistic model of growth than the exponential growth model:

As a real-life example of using the Logistic Growth Model, we would like to model the number of harbor seals in Washington State. From the actual data that was collected, in 1975 there were approximately 1600 harbor seals in Washington State. Through conservation efforts, the population has generally increased and has approached an apparent carrying capacity of about 7500. In this worksheet we would like to model this particular harbor seal population, and in subsequent lectures and assignments we will discuss fitting actual curves to data.

Credit: "Environmental limits to population growth: Figures 1, 2," by OpenStax College, Biology, CC BY 4.0.
The formula that governs the logistic growth of a population \( P \) is

\[
P(t) = \frac{C}{1 + \left(\frac{C - P_0}{P_0}\right)e^{-k(t-t_0)}}
\]

where:

\( P(t) \) = population at time \( t \)
\( C \) = carrying capacity of the population
\( t_0 \) = initial year
\( P_0 \) = initial population (i.e. population at time \( t_0 \))
\( k \) = growth constant that is determined empirically from the data
\( t \) = current year

NOTE: In the above formula, \( e \) denotes the exponential function and is accessed in Excel as \( \exp(\text{argument}) \), where \( \text{argument} \) is replaced by the appropriate expression.

**Your tasks:**

1) Construct a **professional-looking worksheet** similar to that given below that tabulates the growth in this particular population in addition to the population change over the previous year. Please format all numbers in this table as whole numbers except for the Growth Constant, which should be presented with two decimal points:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Carrying Capacity</td>
<td>7500</td>
<td>Year of fastest growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Initial Population</td>
<td>1600</td>
<td>Population at fastest growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Growth Constant</td>
<td>0.30</td>
<td>Estimated Growth constant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Initial Year</td>
<td>1975</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

...Continuing until 45 years after the initial year (so 2020 in this case)

2) Construct **TWO professional-looking graphs** (i.e. change the default formatting to something more appealing), one that shows the growth in the population from 1975 to 2020 (so time is on the x-axis and the population is on the y-axis) and one that shows the CHANGE the population over this same time frame (so time is on the x-axis and the change is on the y-axis). Please label your TWO graphs including x-axis, the y-axis, and the title.

3) With the values for the variables given in the table above, estimate the 1) year in which the fastest growth occurred and 2) the population during the year in which the fastest growth occurred. Put these answers in Cells E1 and E2, respectively.

4) Through experimentation, change the Growth Constant so that the graph of this population most closely resembles the graph of the actual harbor seal population given on the previous page (concentrate on years around 1985). Enter this growth constant in cell E3. After approximating this growth constant, return your table to the values given above.

NOTE: Your worksheet and graphs should update when any of the values in cells B1 to B4 are changed. We will assume, however, that you are running your models for exactly 45 years from the initial year (so, for example, in the initial year is 1920, your table would run from 1920 until 1965).
Worksheet #2 (Name it Bank Statement)

You need to build a worksheet to keep track of your savings and checking accounts balances.

Get the data from the specified address below (remember, the URL is case sensitive!). This provides the initial balance (in the top left corner) in each account and the type and amount of each transaction. The Checking account can have a Deposit, D, or Withdraw, W. The Savings account can have a Deposit, D, or Withdraw, W, or Transfer, T. The Transfer from Savings will always transfer the amount of the transaction from the Savings to the Checking account.

http://zeus.cs.pacificu.edu/lanec/cs130s17/Assignments/BankStatement.html

The worksheet should be setup as shown at the end of this document. Allow the user to change the initial balance of the accounts, any transaction information, or the interest table and have the entire spreadsheet update.

Savings New Balance is the Savings Balance, plus or minus the Transaction Amount, plus the Interest Earned. Checking New Balance is Checking Balance plus or minus the Transaction Amount plus the Transfer Amount.


The interest table determines what interest rate a Savings account earns based on that account’s balance. There are three brackets: High, Mid, and Low. In the example below, you earn 2.00% interest if you have at least $10,000.01 in your account, you earn 1.00% interest if you have at least $5,000.01 in your account, and you earn 0.50% interest otherwise.

**Interest is calculated before a transaction is applied.** You must reference the table in the interest calculation so that any changes to the table will change your calculations automatically. The Checking account does not earn interest.

► I recommend completing the Checking half of the table before starting on the Savings half of the table. The If statements in the Checking half are slightly more simple than the If statements in the Savings half.

Charting:
Below the table build a chart that charts Savings New Balance and Interest Earned for each transaction. Make sure to properly label the chart and ensure that both datasets are readable.

What If Analysis: The user should be able to change any of the input values and see the table and chart update.

Goal Seek:
What over $10,000.01 interest rate will get the last number in the “Savings New Balance” column to $2,000? Place your answer in cell J1.

Formatting:
Be sure to format money and percents correctly. All percents must have two digits past the decimal point. Make sure column headers are justified appropriately. The example is poorly formatted. Note that for money you must use the “Accounting” formatting. The Accounting formatting displays $0.00 as “$ - “.

Use conditional formatting to highlight the Savings Transaction Type if the transaction is a Transfer.
The table portion of this spreadsheet should look similar to the following, although notice that in this example the formatting is poor and the spreadsheet is too large to fit well on this page. You may wish to have the column titles on one line instead of broken across two lines. Be sure to highlight every other row in the table for easy reading.

<table>
<thead>
<tr>
<th>Savings Account Balance</th>
<th>Checking Account Balance</th>
<th>Savings Account Interest Rate</th>
<th>W</th>
<th>Withdraw Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10,000.00</td>
<td>$1,000.00</td>
<td>$10,000.01</td>
<td></td>
<td>2.00%</td>
</tr>
<tr>
<td>$5,000.01</td>
<td></td>
<td>$5,000.01</td>
<td></td>
<td>1.00%</td>
</tr>
<tr>
<td>$0.01</td>
<td></td>
<td>$0.01</td>
<td></td>
<td>0.50%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Savings Balance</th>
<th>Transaction Type</th>
<th>Transaction Amount</th>
<th>Interest Earned</th>
<th>Savings New Balance</th>
<th>Checking Balance</th>
<th>Transaction Type</th>
<th>Transaction Amount</th>
<th>Transfer Amount</th>
<th>Checking New Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10,000.00</td>
<td>W</td>
<td>$800.00</td>
<td>$100.00</td>
<td>$9,300.00</td>
<td>$1,000.00</td>
<td>W</td>
<td>$900.00</td>
<td>$-</td>
<td>$100.00</td>
</tr>
<tr>
<td>$9,300.00</td>
<td>D</td>
<td>$100.00</td>
<td>$93.00</td>
<td>$9,493.00</td>
<td>$100.00</td>
<td>D</td>
<td>$312.00</td>
<td>$-</td>
<td>$412.00</td>
</tr>
<tr>
<td>$9,493.00</td>
<td>T</td>
<td>$1,200.00</td>
<td>$94.93</td>
<td>$8,387.93</td>
<td>$412.00</td>
<td>D</td>
<td>$90.00</td>
<td>$1,200.00</td>
<td>$1,702.00</td>
</tr>
<tr>
<td>$8,387.93</td>
<td>W</td>
<td>$300.00</td>
<td>$83.88</td>
<td>$8,171.81</td>
<td>$1,702.00</td>
<td>W</td>
<td>$30.00</td>
<td>$-</td>
<td>$1,672.00</td>
</tr>
</tbody>
</table>

**Important Note for both worksheets:**
- Changing any values of a worksheet must update the entire worksheet with accurate values based on the given formulas.

**How to Submit and Grading Policies**
A copy of your single Excel file (properly named) with the two worksheets (properly named) is to be placed in the CS130-01Drop Box on Grace by **2:15pm** on the due date to be considered on time.

Grading will be based on:
- Correctness of your results
- Completeness of your results
- Professional look of the worksheets as described above and discussed in class
- Ability to perform a what-if analysis by changing any of the user input data with accurate results computed and displayed in the worksheet.

For each worksheet:
1. Clearly label all the data, and use the cell and table-formatting options to make this spreadsheet easy to read and to give it a professional look.
2. Use Named Cells where appropriate.