Instructions: Each assignment will include a PDF file (like this one) with the assignment questions and an Excel file, with an Answers sheet and any data or models that we provide you with. You must download both the PDF and Excel files. You have to enter your answers in the Answers sheet of the same Excel file you have downloaded, then save and upload the Excel file. You must upload the same Excel file you downloaded. Further instructions are provided in the Online Assignment Tools Guide (see **Assignments** in eClass).

Put your answers in the appropriate cells (salmon-colored cells) in the **Answers** sheet. Use <u>paste special … values</u> to for all numerical answers. The other cells in the Answers sheet are locked, which means you won't be able to enter values into those cells. Do not change the format of cells in the Answers sheet. Save your file with the appropriate name and in the appropriate format ("HW#_ID.xlsx").

Marking will be based on the answers in the Answers worksheet of the file you upload. We will only look at the rest of the file if there is an appeal (and even then, the answers in the Answers sheet take precedence.) If you wish to appeal a mark, then the file you uploaded must include your supporting work for each question. It is a good idea to make one worksheet for each question.

Total points: 18, of which 2 points are for following the submission instructions provided above.

Preliminary Questions (4 pts.)

1. (1 pt.) I understand that I must attend the lab section I am registered in for all in-lab quizzes.
    a. Yes
    b. No
2. (1 pt.) I understand that it is my responsibility to read the course outline (syllabus) and schedule and ask for clarification if necessary.
    a. Yes
    b. No
3. (1 pt.) Do you have access to a home computer (desktop or laptop) with an Internet connection?
    a. Yes, a Windows PC
    b. Yes, a Mac
    c. Yes, other
    d. No
4. (1 pt.) Do you have MS Office on your computer?
    a. Yes, MS Office for Windows
    b. Yes, MS Office for Mac
    c. No

Fisheries Management Model (12 pts.)

These questions are based on the model that we discussed in the lecture. Some parameters have been changed.

- The lake currently has 50,000 trout
- Carrying capacity = 500,000 trout
- Trout population at the end of August:

$$P_{Aug} = P_{Apr} + a \times (1 - (P_{Apr} / \text{capacity})) \times P_{Apr}, \text{ where a = 0.65}$$

- Each fishing license can be sold for $35 in any year
- The discount rate is 5%
- The planning horizon is 30 years (Year 0 to Year 29)

- The end-of-horizon population should be at least 50,000.

5. (1 pt.) The parameter "a" of the lake in the fish model is:
   a) An input
   b) An output

6. (1 pt.) The "April population in Years 1-29" in the fish model is:
   a) An input
   b) An output

A **solution** specifies the number of fish to catch each year. In the remaining questions, we ask you to evaluate two solutions and finally we ask you to find the best solution (with the highest NPV) you can.

Note 1: It is a good idea to make copies of the "Fish" worksheet; one copy for answering and showing your work for each question. Each question is independent, that is, assumptions made in one question do not carry over to the next question.

Note 2: The number of fish can be fractional. Do <u>not</u> round your answers.

7. (2 pts.) Solution 1: Catch **30% of the August population** each year. What is the NPV?

8. (2 pts.) Solution 2: Catch **50% of the August population** each year if the population growth from April to August in that year is greater than or equal to **30,000** fish; otherwise catch nothing. What is the NPV?

9. (6 pts.) Your solution: Find the **highest NPV** you can. Make sure that:

   - The fish population does not become negative, and
   - You must have 50,000 or more fish left at the end of Year 29 (End of Year 29 population = Year 29 August Population - Year 29 September Catch).

Report the **solution** (the number of fish to catch each year) and the **NPV**.

Your answer will be marked based on the following three criteria. (We will use the same approach throughout the course to mark solutions to optimization problems.)

- **Feasibility** (3 pts.): If the solution you report satisfies the constraints that the fish population does not become negative and you have 50,000 or more fish left at the end of Year 29, then you get the marks for feasibility. If your solution satisfies all constraints, then we say that the solution is *feasible*.

- **Consistency** (1 pt.): If the solution you report is entered into a correct model and the resulting NPV is the same as the one you reported, then you get the marks for consistency.

- **Optimality** (2 pts.): If the solution you report is feasible <u>and</u> it results in an NPV that is within 10% of the best we have been able to find, then you get the marks for optimality. *The best solution we were able to find has an NPV of $37,440,000*, when rounded to the closest $1,000. If the NPV of the solution you report is between 10% and 20% below the highest possible NPV, then you get 1 point.

Note 3: If your solution is not feasible, that is, if the fish population becomes negative in any year or if you have less than 50,000 fish left at the end of Year 29, then you get **NO** optimality marks. We will always follow this rule when marking optimization problems.