Practical Task 2.2

(Credit Task)

Submission deadline: 11:59 pm Sunday, August 2nd
Discussion deadline: 11:59 pm Sunday, August 16th

Task Objective

In this task you will use your advanced knowledge and skills of algorithm space and time complexity to answer a series of questions.

General Instructions

In this task, answer all the following questions and complement each answer with a detailed explanation.

1. Task 1.1P asked you to develop / provided you with a number of the Vector<T> class's methods (and properties), such as *Count*, *Capacity*, *Add*, *IndexOf*, *Insert*, *Clear*, *Contains*, *Remove*, and *RemoveAt*. What is the algorithmic complexity of each of these operations? Does your implementation match the complexity of the corresponding operations offered by Microsoft .Net Framework for its List<T> collection? The following link should help you to answer this question

   https://msdn.microsoft.com/en-us/library/6sh2ey19(v=vs.110).aspx

2. f is a function that satisfies the following:
   - f is in $O(n^2)$,
   - f is in $\Omega(n)$,
   - f is neither in $\theta(n)$ nor in $\theta(n^2)$.

   Can you give an example of such a function f? Show that the function you name indeed satisfies all of the above. Also name a well-known algorithm that meets these conditions for all situations (best, worst and average cases).

3. For each pair of functions given below, point out the asymptotic relationships that apply: $f = O(g)$, $f = \theta(g)$, and $f = \Omega(g)$.

   a. $f(n) = n^{\frac{1}{2}}$ and $g(n) = log\, n$
   b. $f(n) = 1500$ and $g(n) = 2$
   c. $f(n) = 800 \cdot 2^n$ and $g(n) = 3^n$
   d. $f(n) = 4^{n+13}$ and $g(n) = 2^{2n+2}$
   e. $f(n) = 9n \cdot log\, n$ and $g(n) = n \cdot log\, 9n$
   f. $f(n) = n!$ and $g(n) = (n+1)!$

Further Notes

- You may find the attached *Asymptotic Cheat Sheet* useful to clarify the mathematical notation.
- You will find ultimate answers to these tasks by exploring chapters 4.1.-4.3 of the course book "Data Structures and Algorithms in Java" by Michael T. Goodrich, Irvine Roberto Tamassia, and Michael H. Goldwasser (2014). You may access the book on-line for free from the reading list application in CloudDeakin available in Resources → Course materials → Course Book: Data structures and algorithms in Java.

Marking Process and Discussion

To get your task completed, you must finish the following steps strictly on time.

1. Work on your task either during your allocated lab time or during your own study time.
2. Once the task is complete you should make sure that your program implements all the required functionality, is compliable, and has no runtime errors. Programs causing compilation or runtime errors will not be accepted as a solution. You need to test your program thoroughly before submission. Think about potential errors where your program might fail. Note we can sometime use test cases that are different to those provided so verify you have checked it more thoroughly than just using the test program provided.
3. Submit your solution as an answer to the task via the OnTrack submission system. This first submission must be prior to the submission "S" deadline indicated in the unit guide and in OnTrack.
4. If your task has been assessed as requiring a "Redo" or "Resubmit" then you should prepare a new submission. You will have 1 (7 day) calendar week from the day you receive the assessment from the tutor. This usually will mean you should revise the lecture, the readings indicated, and read the unit discussion list for suggestions. After your submission has been corrected and providing it is still before the due deadline you can resubmit.
5. If your task has been assessed as correct, either after step 3 or 4, you can "discuss" with your tutor. This first discussion must occur prior to the discussion "D".
6. Meet with your tutor or answer question via the intelligent discussion facility to demonstrate/discuss your submission. Be on time with respect to the specified discussion deadline.
7. The tutor will ask you both theoretical and practical questions. Questions are likely to cover lecture notes, so attending (or watching) lectures should help you with this compulsory interview part. The tutor will tick off the task as complete, only if you provide a satisfactory answer to these questions.
8. If you cannot answer the questions satisfactorily your task will remain on discussion and you will need to study the topic during the week and have a second discussion the following week.
9. Please note, due to the number of students and time constraints tutors will only be expected to mark and/or discuss your task twice. After this it will be marked as a "Exceeded Feedback".
10. If your task has been marked as "Exceeded Feedback" you are eligible to do the redemption quiz for this task. Go to this unit's site on Deakin Sync and find the redemption quiz associated with this task. You get three tries at this quiz. Ensure you record your attempt.
    I. Login to Zoom and join a meeting by yourself.
    II. Ensure you have both a camera and microphone working
    III. Start a recording.
    IV. Select Share screen then select "Screen". This will share your whole desktop. Ensure Zoom is including your camera view of you in the corner.
    V. Bring your browser up and do the quiz.
    VI. Once finished select stop recording.
    VII. After five to ten minutes you should get an email from Zoom providing you with a link to your video. Using the share link, copy this and paste in your chat for this task in OnTrack for your tutor to verify the recording.

11. Note that we will not check your solution after the submission deadline and will not discuss it after the discussion deadline. If you fail one of the deadlines, you fail the task and this reduces the chance to pass the unit. Unless extended for all students, the deadlines are strict to guarantee smooth and on-time work through the unit.
12. Final note, A “Fail” or “Exceeded Feedback” grade on a task does not mean you have failed the unit. It simply means that you have not demonstrated your understanding of that task through OnTrack. Similarly failing the redemption quiz also does not mean you have failed the unit. You can replace a task with a task from a higher grade.