**CSE 3302: Programming Languages**

**Spring 2022**

**Homework 02**

**Due on March 2nd, 2022 [ before 11:59 pm]**

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**1000 number: 0022**

**Date: 3/2/22**

**INSTRUCTIONS**

1. **Do NOT plagiarize.**
2. **No group-work. All work should be your own.**
3. **Do not discuss your work with other students in the class.**
4. **Cite sources where necessary.**
5. **Do not email your documents.**
6. **Name your document as netid.docx where *netid* is your UTA NetID. If you do not know your NetID, check what it is using NetID Self Service. Your 1000 number is NOT your NetID.**
7. **Try to answer each question within 5-7 lines.**

**Questions:**

**1.** Describe the Difference engine. **[7 points]**

**A mechanical calculator created for the purpose of tabulating polynomial functions. It was designed by Charles Babbage in the 1820s and the first of its kind. It could perform only one operation. You had to manually set up every data register with the input data, and the single operation would output a solution.**

**2.** From the following list, which can be considered as a “general purpose computer”? **[3 points]**

a. Step Reckoner - **No**

b. Difference Engine - **No**

c. Analytical Engine – **Recognized as a concept for the first general purpose computer.**

**3.** What were the limitations of Harvard Mark 1? How does current technology deal with those problem? **[7 points]**

**It was remarkably slow for completing calculations. It was programmed using tape, instructions must be read in a linear fashion. Improvement in technology and its hardware makes computing much faster. It also allows us to change the way we program (Not needing to do it in the physical world).**

**4.** Why is Silicon Valley so called? **[3 points]**

**It gets its name due to the fact that it manufacutures a large amount of computer chips which are composed of transistors made with silicon.**

**5.** Make boolean logic tables for AND, OR, and XOR (A XOR B). **[9 points]**

|  |  |  |
| --- | --- | --- |
| AND | | |
| A | B | A AND B |
| 0 | 0 | 0 |
| 1 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 1 | 1 |

|  |  |  |
| --- | --- | --- |
| OR | | |
| A | B | A OR B |
| 0 | 0 | 0 |
| 1 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 1 | 1 |

|  |  |  |
| --- | --- | --- |
| XOR | | |
| A | B | A XOR B |
| 0 | 0 | 0 |
| 1 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 1 | 0 |

**6.** Can we implement XOR gate using only NOT, AND, and OR gates? If yes, how? **[6 points]**

**Yes, as follows: (A AND NOT B) OR (NOT A AND B)**

**7.** How many bits would you need to represent 2018 in binary? How many bytes is that? **[5 points]**

**12 bits : 1.5 bytes**

**8.** Write CSE using ASCII code. Write CSE using Unicode. **[5 points]**

**ASCII - In decimal: C = 67, S = 83, E = 69 → 67 83 69**

**Unicode - In UTF-8: C = 43, S = 53, E = 45 → 43 53 45**

**9.** What were the shortcomings of Assembly languages? **[7 points]**

**It gets really tedious when writing more advanced programs. It is much more difficult to read or understand what something is trying to do compared to a high-level language. Assembly is hardware specific, so it can’t be transferred over to another system without heavily modifying the code itself.**

**10.** What were the advantages and limitations of ALGOL? **[8 points]**

**Advantages:**

**It improved memory usage, had automatic memory management**

**It was capable of recursion**

**Limitations:**

**ALGOL didn’t have input and output functionality**

**Keywords defined to be characters and different uses treated them differently based on the context**

**11.** What is the difference between parameters and arguments of a procedure? Explain with appropriate examples. **[7 points]**

**Arguments are the values passed to a function when that function is called.**

**Parameters are the variables that define the values during a function definition.**

**Ex:**

**let x = 1, y = 1;**

**let add = (param\_x, param\_y) => {return x + y};**

**add(x, y)**

**In this example, x and y are the arguments. param\_x and param\_y are the parameters**

**12.** Write a recursive factorial function/method in C++ or Java (No limitation on number of lines. **[7 points]**

**int factorial(int n){**

**return n ? n\*factorial(n – 1) : 1;**

**}**

**13.** Explain Language Syntax and Language Semantics in your own words. **[10 points]**

**Syntax deals with if something written is valid for the language’s grammar. For example, function call, assignements, and definitions ending with semicolon. Semantics is about what something means in the context of the language. For example, post increment and pre increment operators in a function call. How you use it (the meaning of it) depends on how the language handles those operations.**

**14.** Explain how Java codes are compiled and then interpreted. **[10 points]**

**The code gets compiled and creates a .class file containing byte code. The byte code is not actually executable code, rather, it gets interpreted to convert it into machine code and executed.**

**15.** Explain the following terms: **[6 points]**

a. Syntactic sugar – **Syntax in a language that makes things easier to write and read.**

b. API – **Application programming interface is a standard set of rules or operations that allows computers or applications to commuicate and work with one another.**

**Extra credit (bonus question):**

**16.** Do you think that C programming language is a successful programming language even though it’s not the most popular language today? Explain your reasonings. **[10 points]**

**Yes, because it set the foundation for many of the modern languages that are commonly used today. Many of the languages developed after C include features that were introduced by C. For instance, memory management and syntax.**