Introduction to Computer Science

Assignment 06

Constructor University,
Bremen, Germany

March 19, 2024

- Marks are only awarded for producing the correct solutions and justifying how you arrived at them.
- Please write legibly. Illegible answers will NOT be marked.

Question 1

IEEE-754 floating point numbers are encoding using 32 bits. The encoding starts with a sign bit, followed by 8 bits for the biases exponent, followed by 23 bits for the mantissa. For single-precision floating-point numbers, the exponents in the range of -126 to +127 are biased by adding 127 to get a value in the range 1 to 254 (0 and 255 have special meanings).

1. Explain step-by-step how the decimal number 4.2×10^8 (in scientific notation) gets converted into a single-precision floating point number. **[2 marks]**
2. Explain step-by-step how the single precision floating point number:

   1 01111011 10000000000000000000000

   is converted into a decimal representation. **[2 marks]**

Question 2

The content of a file containing UTF-8 Unicode encoded text is given by the following sequence of bytes in hexadecimal notation:

f0 9f a4 93 20 3d 20 f0 9f 98 8e

1. Write each byte in binary notation. **[1 mark]**
2. Identify the unicode code points of the characters. What is the text stored in the file? **[2 marks]**

Question 3

Algebraic Data Types in Haskell:

1. Construct a data type called `Person` with a single constructor such that any variable (object) of this type is able to store a person's first name (`String`), age (`Int`), and status (`Bool`) indicating whether the person is a student. **[1 mark]**
2. Make the type `Person` a member of the class `Show` explicitly by using the `instance` construct and implementing the `show` function for this type. **[1 mark]**
3. Code a function `newAge` for changing the age of a `Person`. **[1 mark]**