CSE2315 — Assignment 1

Vlad Paun
6152937

February 10, 2026

1 Exercise 1

Consider a language $L = \{ok, a, bad, dab, abba, hi, \varepsilon, acc, duck\}$

a) Give a possible Σ such at $L \subseteq \Sigma^*$

$$\Sigma = \{a, b, c, d, h, i, k, o, u\}$$

b) Why is this only possible Σ

Supposing this question is asking why this is the only possible **minimal** alphabet, the answer is that it must contain exactly the set of symbols that appear in the words in L, and that set is uniquely determined.

c) Give all words in L in shortlex order

$$\varepsilon, a, hi, okacc, bad, dab, abba, duck$$

2 Exercise 2

Consider the following claims (a) and (b). For each claim, verify whether it is true for arbitrary languages $L_1 \subseteq \Sigma_1^*$,$L_2 \subseteq \Sigma_2^*$,$L_3 \subseteq \Sigma_3^*$,$L_4 \subseteq \Sigma_4^*$. If a claim is true, give a proof; if it is not true, give a counterexample with an explanation how the counterexample shows the claim is false

3 Exercise 3

4 Exercise 4

5 Exercise 5

6 Bonus Exercise

Clearly describe the problem. Use math mode where appropriate:

$$f(n) = \sum_{i=1}^{n} i^2$$

7 Approach

Explain your reasoning, definitions, and structure.

7.1 Definitions

Definition 1. *A function* $f : \mathbb{N} \to \mathbb{N}$ *is* monotone *if* $f(n+1) \geq f(n)$.

7.2 Lemma Example

Lemma 1. *For all* $n \in \mathbb{N}$, $n^2 \geq n$.

Proof. For $n \geq 1$, we have $n^2 - n = n(n-1) \geq 0$. □

8 Algorithm

Algorithm 1 Example Algorithm

Input: Integer n
Output: Sum of first n integers

```
s ← 0
for i ← 1 to n do
    s ← s + i
end for
return s
```

9 Results

Tables look clean with `booktabs`:

n	Value	Time
10	55	0.01s
100	5050	0.02s

10 Conclusion

Summarize findings briefly.