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*Answer by filling the pdf, save it as pdf, and upload to UGLA latest on Monday 4.9.2017.***Problems:**

1. Let \mathcal{P} denote the set of polynomials with integer coefficients, i.e., functions $\mathbb{R} \rightarrow \mathbb{R}$ of form $a_0 + a_1x + a_2x^2 + \dots + a_nx^n$, where the a_i are integers. Hence, e.g., $f(x) = 1 - x^2$ belongs to \mathcal{P} , while $x/2$ and $\sin(x)$ do not. Define mappings (functions)

$$I(f) = \int_0^x f(s) ds, \quad D(f) = \frac{d}{dx} f(x) = f'(x),$$

i.e., a definite integral and derivative of a given function f , yielding another function as a result.

- a) Is \mathcal{P} closed under integral $I(f)$? Yes/No: _____
- b) Is \mathcal{P} closed under derivation $D(f)$? Yes/No: _____
2. Let A be a regular language, $B = A^*$, and $C = A \circ B$.
- a) Is $A = B$? _____ (yes/no)
- b) Is $B = C$? _____ (yes/no)
- c) Is $C = A$? _____ (yes/no)
3. Consider the two NFAs of Problem 1.16 from the book. Which one of the following strings the machines accept:

	Machine (a)	Machine (b)
aaaaa	<u>Yes/No: _____</u>	<u>Yes/No: _____</u>
bbbbb	<u>Yes/No: _____</u>	<u>Yes/No: _____</u>
abba	<u>Yes/No: _____</u>	<u>Yes/No: _____</u>
baba	<u>Yes/No: _____</u>	<u>Yes/No: _____</u>

4. Does a self-transition with symbol ϵ make any sense with NFAs? Yes/No: _____
5. Suppose $\Sigma = \{0, 1\}$ and let M_i denote an NFA that recognizes the strings with the i th last symbol 1, and \bar{M}_i its complement, i.e., an NFA that recognizes string where the i th last bit is zero.
- a) Does $M_1 \cap M_2 \cap \bar{M}_3 \cap M_4$ recognize string 11101101011? Yes/No: _____
- b) Does $M_1 \cup M_2 \cup \bar{M}_3 \cup M_4$ recognize string 1111111111? Yes/No: _____
- c) Does $(M_1)^*$ recognize string 1011? Yes/No: _____
6. Consider the Exercise 1.24 from the book and FST T_1 .
- a) What is the output on input 011: _____
- b) What is the output on input 211: _____
- c) What is the output on input 0202: _____