

Part 1 - Regular Expressions

- A. Create a **single** regular expression that matches a string of digits and contains exactly two fives. Examples of acceptable strings include: "15445 ", " 55 ", " 05563 ". However, the string is to be rejected if it contains anything other than digits.
- B. Create a **single** regular expression that matches a time expressed in the form "1:45 PM".

Additional notes:

- The hours part must be a number from 1 to 12, the minutes range from 00 to 59, and the time must indicate either AM or PM (uppercase only and preceded by exactly one space).

- C. Create a **single** regular expression that matches a string representing a comma separated list of variable names such as:

hello, get_max, sum3

Additional notes:

- A variable name consists of letters, digits, and underscores but cannot start with a digit.
- There is exactly one space after every comma. No other spaces are allowed.
- Commas and spaces are not allowed before the first name and after the last name.
- An empty string is considered a match.
- It is not a match if the list is not properly formed or if one of the variable names is invalid.

- D. Create a substitution, using a regular expression, that replaces all less than (<) and less than and equal to (<=) expressions with the equivalent greater than (>) or greater than or equal (>=). For instance, "a < b" would be replaced with "b > a".

Additional notes:


- Note that you only have to swap the less-than operators, not the greater-than ones.
- Only swap the "word" before and after the comparison. A word consists of letters, digits, and underscores.
- Zero or more spaces may separate the comparison operator and the words. When performing the substitution, use one space to separate the comparison operator from the words.
- Do not perform the substitution if there is comparison does not contain a word before and/or after the comparison. For example, a '<' sign appears at the beginning of the string.
- You may assume that the string does not contain any chained comparisons like $a < b < c$.

Part 2 - DFA

Create DFA for the following language specifications. The DFA must be expressed as files that can be used as inputs for the DFA simulator described in the provided document.

- A. All strings on $\Sigma = \{A, B, C\}$ that contain each letter (A, B, and C) at least once.
- B. All strings on $\Sigma = \{X, Y, Z\}$ that contains two consecutive X's or three consecutive Z's (or both).
- C. All strings on $\Sigma = \{A, B, C, D\}$ that adhere to this Python regular expression: `^(A?(B|CD)*A+D)$`

Provided Files:

- The [zip file](https://seattleu.instructure.com/courses/1602042/files/67685061/download?download_frd=1)  (https://seattleu.instructure.com/courses/1602042/files/67685061/download?download_frd=1) contains:
 1. The hw6_template.py (**rename** this to hw6.py for the file you hand in)
 2. Test program template, hw6_test.py (modify this to have more tests--this is not handed in)
 3. DFA Simulator (dfa.py -- this is for testing your dfa files that you will submit--do not submit this test program)
 4. DFA Documentation (dfa.docx)
 5. DFA Example (dfa_example.txt and strings_example.txt -- do not submit these files)

Submission

Submit **four** files with these **exact** names:

1. ***hw6.py*** - this is Part 1 and contains five global variable assignments as in hw6_template.py
2. ***dfa1.txt*** - this is your DFA for Part 2.A
3. ***dfa2.txt*** - this is your DFA for Part 2.B
4. ***dfa3.txt*** - this is your DFA for Part 2.C

HW6 Rubric

Criteria	Ratings										Pts
Regular Expression a	6 pts Passed all tests	4 pts 4 points Failed 1-2 accepting tests; passed all rejecting tests	4 pts 4 points Passed all accepting tests; failed 1-2 rejecting tests	3 pts 3 points Failed 3 or more accepting tests; passed all rejecting tests	3 pts 3 points Passed all accepting tests; failed 3 or more rejecting tests	2 pts 2 points Failed 1-2 accepting tests; failed 1-2 rejecting tests	1 pts 1 point Failed 1-2 accepting tests; failed 3 or more rejecting tests	1 pts 1 point Failed 3 or more accepting tests; failed 1-2 rejecting tests	1 pts 1 point Either accepts all tests or rejects all tests	0 pts No credit	6 pts
Regular Expression b	6 pts Passed all tests	4 pts 4 points Failed 1-2 accepting tests; passed all rejecting tests	4 pts 4 points Passed all accepting tests; failed 1-2 rejecting tests	3 pts 3 points Failed 3 or more accepting tests; passed all rejecting tests	3 pts 3 points Passed all accepting tests; failed 3 or more rejecting tests	2 pts 2 points Failed 1-2 accepting tests; failed 1-2 rejecting tests	1 pts 1 point Failed 1-2 accepting tests; failed 3 or more rejecting tests	1 pts 1 point Failed 3 or more accepting tests; failed 1-2 rejecting tests	1 pts 1 point Either accepts all tests or rejects all tests	0 pts No credit	6 pts
Regular Expression c	6 pts Passed all tests	4 pts 4 points Failed 1-2 accepting tests; passed all rejecting tests	4 pts 4 points Passed all accepting tests; failed 1-2 rejecting tests	3 pts 3 points Failed 3 or more accepting tests; passed all rejecting tests	3 pts 3 points Passed all accepting tests; failed 3 or more rejecting tests	2 pts 2 points Failed 1-2 accepting tests; failed 1-2 rejecting tests	1 pts 1 point Failed 1-2 accepting tests; failed 3 or more rejecting tests	1 pts 1 point Failed 3 or more accepting tests; failed 1-2 rejecting tests	1 pts 1 point Either accepts all tests or rejects all tests	0 pts No credit	6 pts
Regular Expression d	8 pts Passed all tests		6 pts Failed one test		4 pts Failed two tests		2 pts Failed three tests		0 pts Failed four or more tests		8 pts
DFA 1	8 pts Passed all tests	6 pts 6 points Failed 1-2 accepting tests; passed all rejecting tests	6 pts 6 points Passed all accepting tests; failed 1-2 rejecting tests	4 pts 4 points Failed 3 or more accepting tests; passed all rejecting tests	4 pts 4 points Passed all accepting tests; failed 3 or more rejecting tests	4 pts 4 points Failed 1-2 accepting tests; failed 1-2 rejecting tests	2 pts 2 points Failed 1-2 accepting tests; failed 3 or more rejecting tests	2 pts 2 points Failed 3 or more accepting tests; failed 1-2 rejecting tests	1 pts 1 point Either accepts all tests or rejects all tests	0 pts No credit	8 pts

Criteria	Ratings										Pts
DFA 2	8 pts Passed all tests	6 pts 6 points Failed 1-2 accepting tests; passed all rejecting tests	6 pts 6 points Passed all accepting tests; failed 1-2 rejecting tests	4 pts 4 points Failed 3 or more accepting tests; passed all rejecting tests	4 pts 4 points Passed all accepting tests; failed 3 or more rejecting tests	4 pts 4 points Failed 1-2 accepting tests; failed 1-2 rejecting tests	2 pts 2 points Failed 1-2 accepting tests; failed 3 or more rejecting tests	2 pts 2 points Failed 3 or more accepting tests; failed 1-2 rejecting tests	1 pts 1 point Either accepts all tests or rejects all tests	0 pts No credit	8 pts
DFA 3	8 pts Passed all tests	6 pts 6 points Failed 1-2 accepting tests; passed all rejecting tests	6 pts 6 points Passed all accepting tests; failed 1-2 rejecting tests	4 pts 4 points Failed 3 or more accepting tests; passed all rejecting tests	4 pts 4 points Passed all accepting tests; failed 3 or more rejecting tests	4 pts 4 points Failed 1-2 accepting tests; failed 1-2 rejecting tests	2 pts 2 points Failed 1-2 accepting tests; failed 3 or more rejecting tests	2 pts 2 points Failed 3 or more accepting tests; failed 1-2 rejecting tests	1 pts 1 point Either accepts all tests or rejects all tests	0 pts No credit	8 pts

Total Points: 50