

- You shall receive feedback on the problems *only if*:
    1. You submit to Ekanshdeep by **2359 hrs on Thursday, October 17, 2019**, and
    2. **Submit each problem in a separate sheet** with your name on each sheet. This is essential because the TAs divide correction duties by problem.
  - This problem set should take you approximately an hour to solve. This is the pace that will be expected in the quizzes.
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*“To loop is human; to recurse is divine.”* – L. Peter Deutsch

For questions 1 & 2, construct Turing Machines that accept the given languages. You do not need to explicitly define the 7-tuple. Instead, write in clear and concise steps, as done in Examples 3.6 and 3.7 from Sipser’s book.

1.  $\{ww \mid w \in \{a, b\}^*\}$
2.  $\{b_1\#b_2 \mid b_1, b_2 \in \{0, 1\}^*, \text{ as binary numbers } b_1 > b_2\}$

For questions 3 & 4, consider the following closure properties :

- (a) union
- (b) concatenation
- (c) complementation
- (d) star
- (e) intersection
- (f) homomorphism
- (g) inverse homomorphism

For the above closure properties :

3. Justify if they hold for recursive languages.
  4. Justify if they hold for recursively enumerable languages.
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