***Homework** #7 due December 20 , 2016, Tuesday*

Question 1

Consider the *PDA* $P = (Q, \Sigma, \Gamma, \delta, Z_0, q_0, F)$ and the *DFA* $A = (Q_A, \Sigma, \delta_A, q_{0A}, F_A)$.
We define the product *PDA* $P \times A := (Q \times Q_A, \Sigma, \Gamma, \delta \times \delta_A, Z_0, (q_0, q_{0A}), F \times F_A)$
where the product transition function $\delta \times \delta_A$ is defined as :
$((q', r'), \gamma) \in (\delta \times \delta_A)((q, r), a, X)$ ***iff :***
(i) $(q', \gamma) \in \delta(q, a, X) \wedge r' = \delta_A(r, a)$, *if* $a \in \Sigma$, $X \in \Gamma$;
(ii) $(q', \gamma) \in \delta(q, a, X) \wedge r' = r$, *if* $a = e$, $X \in \Gamma$

(1) Show by using the definition above and an appropriate induction argument that the computation function for the product *PDA* $P \times A$ is characterized by

$((q, r), s, \alpha) \mid\!\!-\!\!-^*_{(P \times A)} ((q', r'), e, \gamma)$ *for* $s \in \Sigma^*$; $\alpha, \gamma \in \Gamma^*$ iff :
(i) $(q, s, \alpha) \mid\!\!-\!\!-^*_P (q', e, \gamma)$
(ii) $r' = \delta_A E(r, s)$
where $\delta_A E$ is the extended transition function of A.
(2) Show using (1) that the language accepted by $P \times A$ is $L_P \cap L_A$

Question 2

A *CFG* is called *right linear* if ***all*** productions are of the form $A \rightarrow a\, B$ or $A \rightarrow e$ and called *left linear* if ***all*** productions are of the form $A \rightarrow B\, a$ or $A \rightarrow e$ where $A, B \in V$ and $a \in T$ and e is the empty string.
Show that both *right linear* and *left linear* grammars generate *regular languages*. Specify finite state machines corresponding respectively to right and left linear grammars.

Main Text : Exercise 7.1.3 , 7.1.4 , 7.2.1 (b),(c) , 7.4.3(b),(c)