1. Use a general algorithm to construct a (non-deterministic) pushdown automaton that corresponds to the context-free grammar with the starting variable $S$ and the following rules:

$$S \rightarrow bAA; \; A \rightarrow Sa; \; A \rightarrow aS; \; \text{and} \; S \rightarrow b.$$  

Show, step by step, how the word $bbaab$ will be accepted by this automaton. Its derivation in the given grammar is as follows:

- first, we use the rule $S \rightarrow bAA$;
- to the first $A$, we apply the rule $A \rightarrow Sa$ and to the second $A$, we apply the rule $A \rightarrow aS$; as result, we get $bSaaS$;
- finally, to both remaining $S$ variables, we apply the rule $S \rightarrow b$.