**3** Prove that the problem associated with language $A_{TM}$ defined below is undecidable. You are given that HALT = {<*M*, *w*>: *M* is a Turing machine and *M* halts on *w*} is undecidable. Use the template provided to perform a mapping reduction. You must give your answer on this exam question sheet.

**EX8** The language $L_3$ is defined as $L_3$ = {<*M, w*>: *M* is a TM that does not accept *w*}.

**EX9** The language $L_3$ is defined as $L_3$ = {<M>: M is a Turing machine and M accepts at most one word}.

**EX10** The language $L_3$ is defined as $L_3$ = {<*M*, *a*, *b*>: *M* is a Java program, *a* and *b* are integer variables declared in *M*, and when *M* is run, *a* is never less than *b*}.

**EX11** The language $L_3$ is defined as $L_3$ = {<*M*>: *M* is a Java program, and when *M* is run it never raises an exception}.

**EX12** The language $L_3$ is defined as $L_3$ = {<M>: M is a Turing machine and |L(M)| does not contain any words of length greater than five symbols}.

**EX13** The language $L_3$ is defined as $L_3$ = {<M>: M is a Turing machine and |L(M)| does not contain any words of length less than five symbols}.