Specification and Verification I

(a) Explain the difference between a variant and an invariant. Briefly describe what they are used for. [4 marks]

(b) State and justify the verification conditions for the total correctness of WHILE commands. [6 marks]

(c) (i) Devise a precondition $P$ that makes the following specification true.

\[
[P] \\
\text{WHILE } I \leq N \text{ DO SUM := SUM+(2}\times I); \ I := I+1 \\
\text{[SUM = N}\times(N+1)]
\]

[2 marks]

(ii) Devise and justify annotations for this specification that yield provable verification conditions. [8 marks]