Topics in Concurrency

(a) Describe the semantics of the modal $\mu$-calculus. [4 marks]

(b) Describe without proof the meaning of the following modal $\mu$-calculus assertions:

(i) $\nu Z. \langle c \rangle Z$; [1 mark]

(ii) $\mu Z. \langle c \rangle Z$; [1 mark]

(iii) $\nu Z. (A \land ([c] F \lor \langle c \rangle Z))$ (here $F$ means false); [2 marks]

(iv) $\mu Z. (B \lor (A \land \langle c \rangle Z))$; [2 marks]

(v) $\nu Z. (B \lor (A \land \langle c \rangle Z))$. [2 marks]

(c) Consider the transition system consisting of two states $p, q$ and two transitions $p \xrightarrow{c} q$ and $q \xrightarrow{c} p$.

(i) Does $p$ satisfy $\mu Z. ([c] F \lor (\langle c \rangle T \land \langle c \rangle Z))$?

(ii) Does $p$ satisfy $\nu Z. ([c] F \lor (\langle c \rangle T \land \langle c \rangle Z))$?

(Again, here $F$ means false and $T$ means true.) In this part you should justify your answers carefully. [8 marks]