3 Comparative Architectures (TMJ)

(a) Throughout the 1990s mainstream microprocessors were developed with ever deeper pipelines. Since then manufacturers have scaled back to more moderate pipeline depths.

(i) What were the benefits from implementing deep pipelines and why were they scaled back? [4 marks]

(ii) How do pipelines that support in-order and out-of-order execution differ in their microarchitectural components? [4 marks]

(b) Modern high-performance processors incorporate a dynamic branch predictor to avoid stalling when branches are fetched.

(i) What is a tournament branch predictor and why might it outperform either a global or local branch predictor alone? [4 marks]

(ii) You develop a new branch predictor that is significantly more accurate than existing designs. However, its complexity means that it takes several cycles to produce a prediction. How can you make use of this predictor without always introducing a pipeline bubble? [4 marks]

(iii) If you were designing an out-of-order core, why might you decide not to allow predicated execution? [4 marks]