**COMPUTER SCIENCE TRIPOS Part II – 2014 – Paper 8**

## 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]