Concurrent Systems

In a system which allocates resources dynamically

(a) What are the resource allocation policies that make it necessary to consider the possibility of deadlock? [3 marks]

(b) If there is one instance of each resource type what is the necessary and sufficient condition for deadlock to exist? [2 marks]

Using the notation

* for an instance of a resource

\[
\begin{align*}
\text{\textbullet} & \quad \text{process P has an instance of resource R} \\
\text{\textbullet} & \quad \text{process P is requesting an instance of resource R}
\end{align*}
\]

(c) Draw a resource–wait graph for five processes where at least three are deadlocked. [5 marks]

(d) Give the allocation and request matrices corresponding to your graph. [5 marks]

(e) Illustrate a deadlock detection algorithm using your matrices as an example. [5 marks]