DVA482: Assignment 5

Question 1 (Related to the Multi-core lecture)

a) What does cache coherency refer to?
b) Is shared memory always the best method for communicating among cores? When does it become problematic?
c) Describe two main scheduling approaches in multiprocessor systems, their strengths and weak points?

Question 2: (Related to the System-level Design lecture)

Describe various aspects and constraints that have a large impact on the result of an embedded system design.

Question 3: (Related to the Cloud, IoT, Resource Virtualization in ES lecture)

Consider a FOG node that has a number of virtual machines allocated to multicore. Core 1 has three different virtual machines VM1, VM2 and VM3. (Q1=2, P1=4), (Q2=3, P2=8) and (Q3=2, P3=16) where Q1, Q2, Q3 are budgets for VM1, VM2, VM3 respectively and P1, P2, P3 are periods of VM1, V2, VM3.

VM1 has three periodic tasks τ1, τ2, τ3 and each task is characterized by C=execution time, T=period and D=deadline. C1=2, T1=D1=8, C2=3, D2=T2=16, C3=2, D3=T3=32

VM2 has two periodic tasks τ4, τ5 with parameters C4=3, T4=16, D4=10, C5=3, T5=16 and D5=15. VM3 has one periodic task τ6 with parameters C6=2, T6=16, D6=14

Assume that the fixed priority-scheduling algorithm is used for all schedulers (global and local) and priorities are selected based on the deadline monotonic approach.

a) Will all tasks meet their deadlines? Motivate your answer by drawing the execution trace of VMs and tasks.
b) If we change the global level scheduler to EDF what will happen?
c) If there are some tasks that miss their deadlines, what can be done to make them meet their deadlines without changing the given parameters of tasks and VMs? (Hint: see Lecture 4: Schedulability Analysis)
d) (Optional) Suppose that there is one more copy of VM2 and another one of VM3 and there are two cores available to execute the 5 VMs. How will you distribute the VMs so that all tasks meet their deadlines? Please motivate your design.