UCR CS122B, Winter 2007

Advance Embedded and Real Time Systems

Prof. Harry Hsieh

Homework #3

Due Date: Friday, 3/9, 11:59PM
No late homework will be accepted

You may work in group, but you must turn in your own write-up.

1) (20 points) Give the following access sequence (a b c d e f a d a d a c d f a d c a d f b c b d b a e f)
    a. Draw the access graph
    b. Use Liao's algorithm with tie breaking, solve the memory allocation problem and draw the memory layout.
    c. Set up a genetic algorithm solver for the given problem by specifying
        i. Give an initial population of at least 2 solutions
        ii. How to evaluate a solution?
        iii. How to select parents for reproduction?
        iv. How do you perform reproduction? (no giggling, pleaes)
        v. How do you perform mutation?

2) (10 points) Give a task that executes 5 billion cycles.
    a. What is the lowest power frequency to run the task at if the deadline is 1000 seconds.
    b. What is the lowest power freqnency to run the task at if the deadline is 100 seconds.
    c. Given the following 3 possible fixed voltage

V_{dd} [V]	5.0	4.0	2.5
Energy per cycle [nJ]	40	25	10
f_{max} [MHz]	50	40	25
cycle time [ns]	20	25	40

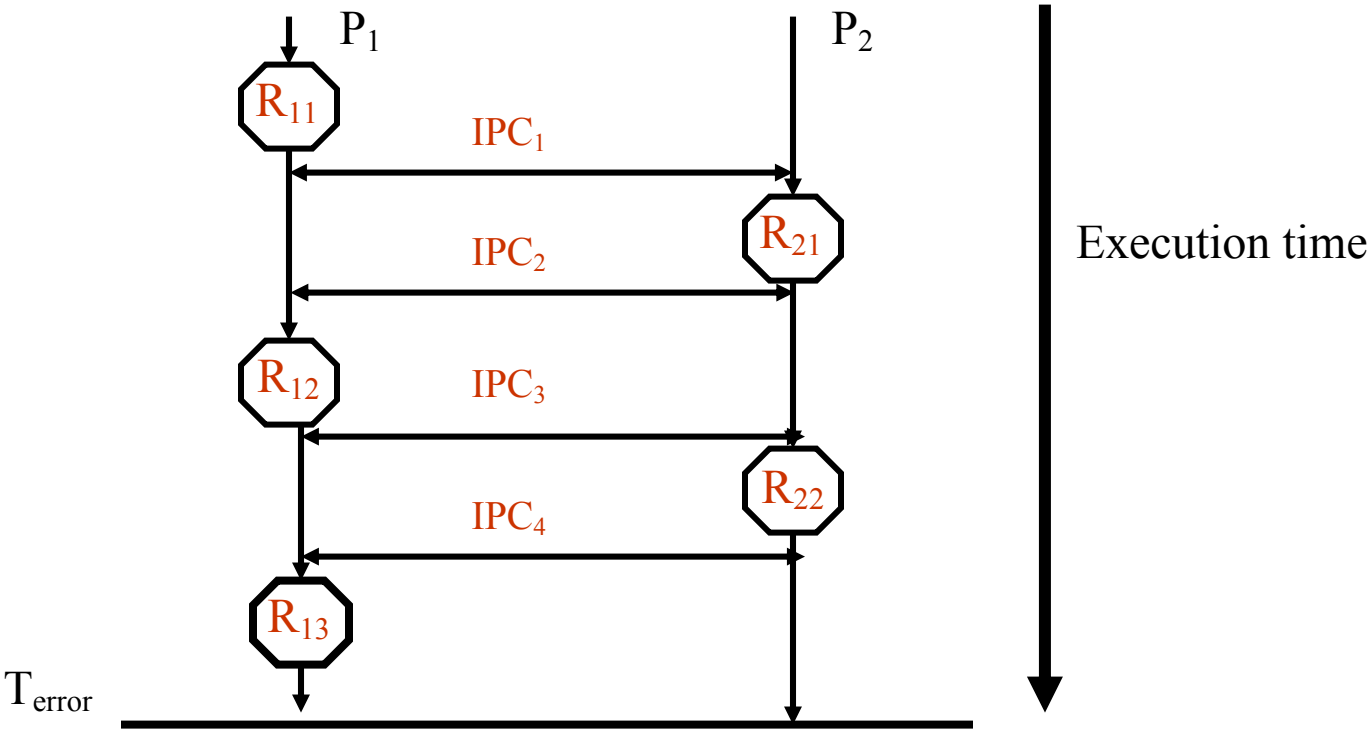
What is the best voltage usage if the deadline is 120 seconds

3) (5 points) Define the following terms:
    a. Fault tolerance
    b. Fail safe
    c. Graceful degration
    d. TMR

4) (5 points)
    a. Define and compare the advantage and disadvantage of static and dynamic redundancy for fault tolerance computating.

b. Define and compare the advantages and disadvantages of forward and backward error recovery methods.

5) (5 points) Given the following execution, explain what happened if the error is found to be in P2? (R's are recovery points)



6) (5 points) Given 4 accelerators for some given application:
   a. Under what circumstances would it makes sense to couple all accelerators tightly. Why is it beneficial to couple all the accelerators tightly?
   b. Under what circumstances would it makes sense to couple all accelerators loosely. Why is it beneficial to couple all the accelerators loosely?

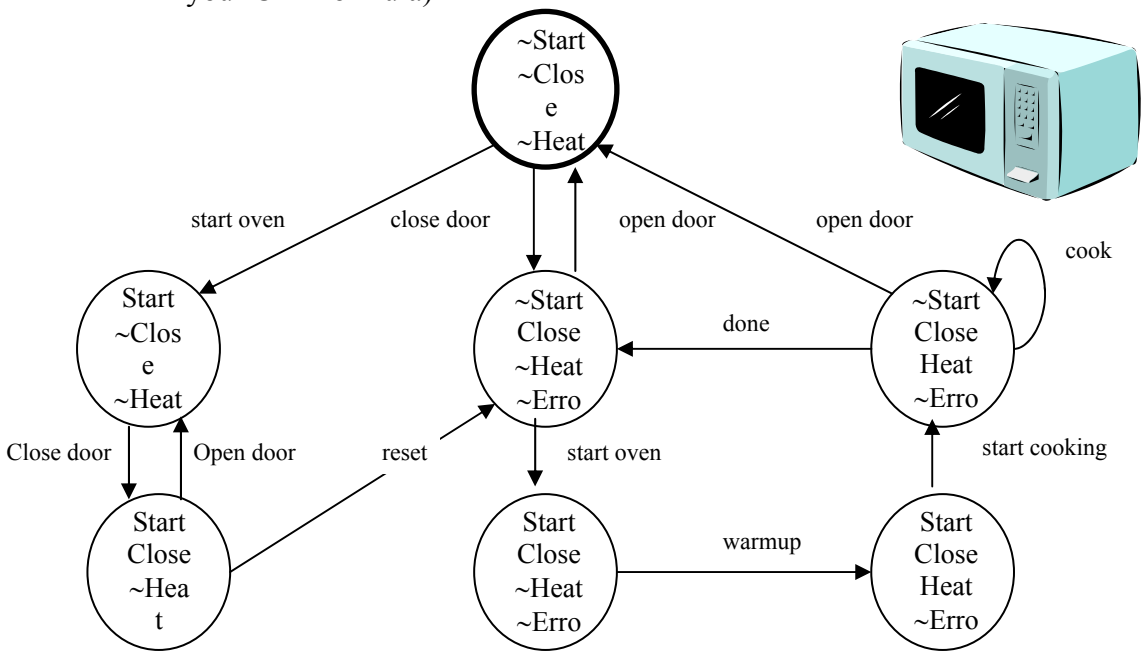
7) (15 points) Given 4 accelerators with the following characteristics:

	a_1	a_2	a_3	a_4
Max Freq:	1000	800	400	100
Cycles:	50	10	20	100

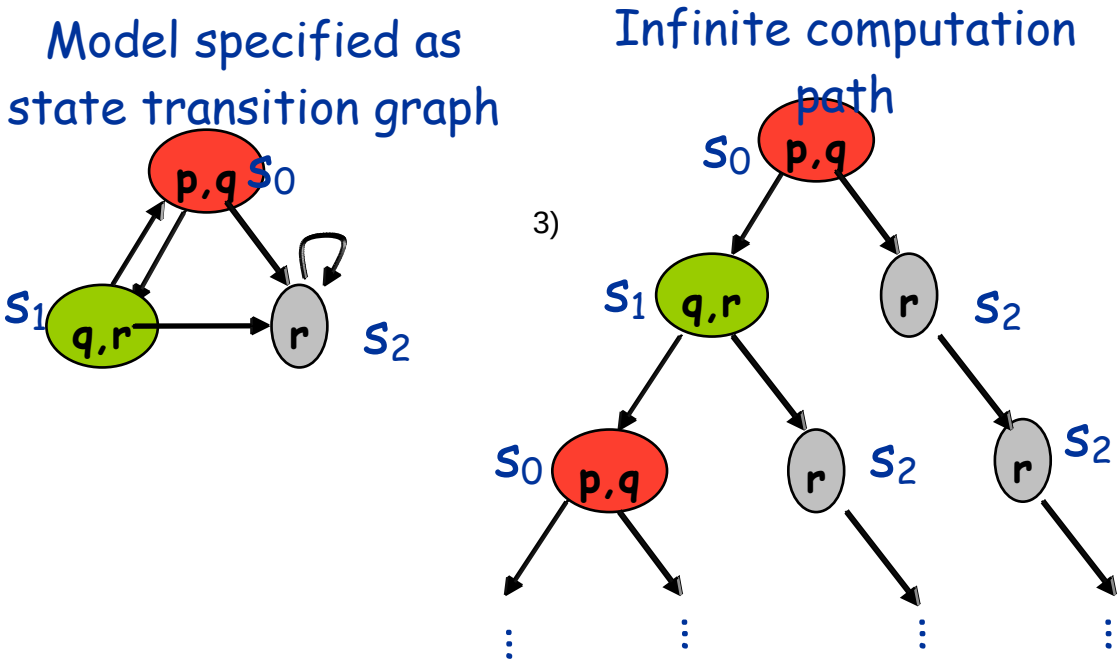
derive the X(A,C) table. According to the dynamic programming algorithm, what is the best clock partitioning if we have 3 clock frequencies available?

8) (20 points) For the microwave oven example, run the CTL modeling checking algorithm for the following properties, **show each step**:

a. It must be possible to correct errors AG (Error -> AF (not Error))
b. Once we start the oven, Heat will always eventually be turned off (write your CTL formula)



9) (10 points) Given model M and its computation path:



Does the following CTL query hold on the model? Explain your answer.

c. M, s0 ⊨ A[p U r] ?
d. M, s0 ⊨ AG[p V q V r → EF EG r] ?

10) (10 points)

a) Given variable order [x1, x3, x2, x4], use ROBDD operations to compute the ROBDD encoding the function f : f = x1’x2’x3’x4’+ x1’x2’x3x4’+ x1x2’x3’x4+x1’x2x3’x4’
b) Repeat using variable order [x1, x3, x4, x2].