Solutions PART I (60 points)

Answer Q1: See the actor diagram in the model "exam june 2008_Q1-3.xmb"

Answer Q2: See the behaviour diagram 2 in the model "exam june 2008_Q1-3.xmb"

Answer Q3-a: *The first option refers actually to real-time processing of newly available houses on the market, while the second option is a batch type of processing with a batch period of two weeks. The real time processing is more efficient in terms of completion time: batch-processing may increase unnecessarily the duration of many instances of the process to two weeks. Especially, if we take into account the fact that in particular the house market is low volume one (at a particular instance in time only hundreds of houses are available on the market in a rather large municipality, such as Enschede), we may infer that the number of new houses in a week may not be very high.*
Batch processing is more efficient in terms of costs: processing multiple houses in one pass is more cost-efficient (under the condition that the volume of newly available houses is fairly high and/or the house market is rather static, i.e. the waiting time for selling a house is more than 6 months) then the alternative since it allows the grouping and totalling of houses, and thus decreases the workload in the house searching process.

Answer Q3-b: See the behaviour diagram 3b in the model "exam june 2008_Q1-3.xmb" (published on Teletop).

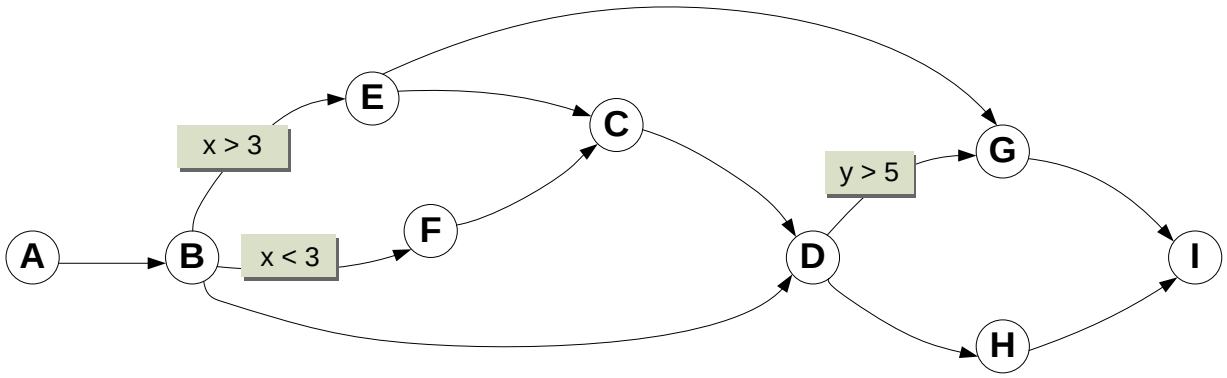
Answer Q3-c: *The following modifications may lead to an improvement of the completion time of REA's process (see behaviour diagram 3c in the model "exam june 2008_Q1-3.xmb" -published on Teletop):*

- *Checking the status of the house can be done in the very beginning, in parallel with searching for potential buyers. It has two advantages: first, in parallel means lower completion time and, second, if a house has a bad status the REA may save time by not visiting it (in the original version visitations and status checking was done in parallel).*
- *Finding a notary and preparing the contract can also be done in parallel.*
- *Automation of certain steps in the process (e.g., buyer profile definition can be done online by the buyer, etc.).*

Apart from these improvements is little to be done due to the dependencies between the various steps in the process.

Question 4 (24 points)

Semantics of the join nodes is AT_LEAST_ONE!



Question 4.a (4 points)

Acticities A, B, D, H, and I will be always executed!

Question 4.b (12 points)

I_1: START(A); END(A); START(B), END(B)[x=4] **(4 points)**

Activity	State
A	completed
B	completed
C	not activated
D	not activated
E	activated
F	skipped
G	not activated
H	not activated
I	not activated

$I_{2:}$ START(A); END(A); START(B), END(B)[x=3] **(4 points)**

Activity	State
A	completed
B	completed
C	skipped
D	activated
E	skipped
F	skipped
G	not activated
H	not activated
I	not activated

$I_{3:}$ **…** START(D); END(D)[y = 2]; START(G); START(H) **(4 points)**

Activity	State
A	completed
B	completed (with x > 3!!)
C	Completed
D	Completed
E	Completed
F	Skipped
G	running (started)
H	running (started)
I	not activated

Remark:

D was completed with y = 2, i.e., the control connector (D,G) was signaled as false. Since G has been started, this activity must have been activated via the control connector (E,G). Consequently, activity E must posess the state completed. Since E was completed, F could not have been executed (due to the define transition conditions), i.e., F has state skipped.

Note that here I assumed that B was completed with x > 3. If this is not the case, the states will look different. So you will have to check this with respect to the solutions suggested by students.

Question 4.c (4 points)

First, we have to draw a data connector from activity C to activity D.

To exactly specifiy which data shall be exchanged between these two activities, we have to map data fields of the output container of C to data fields of D's input container.

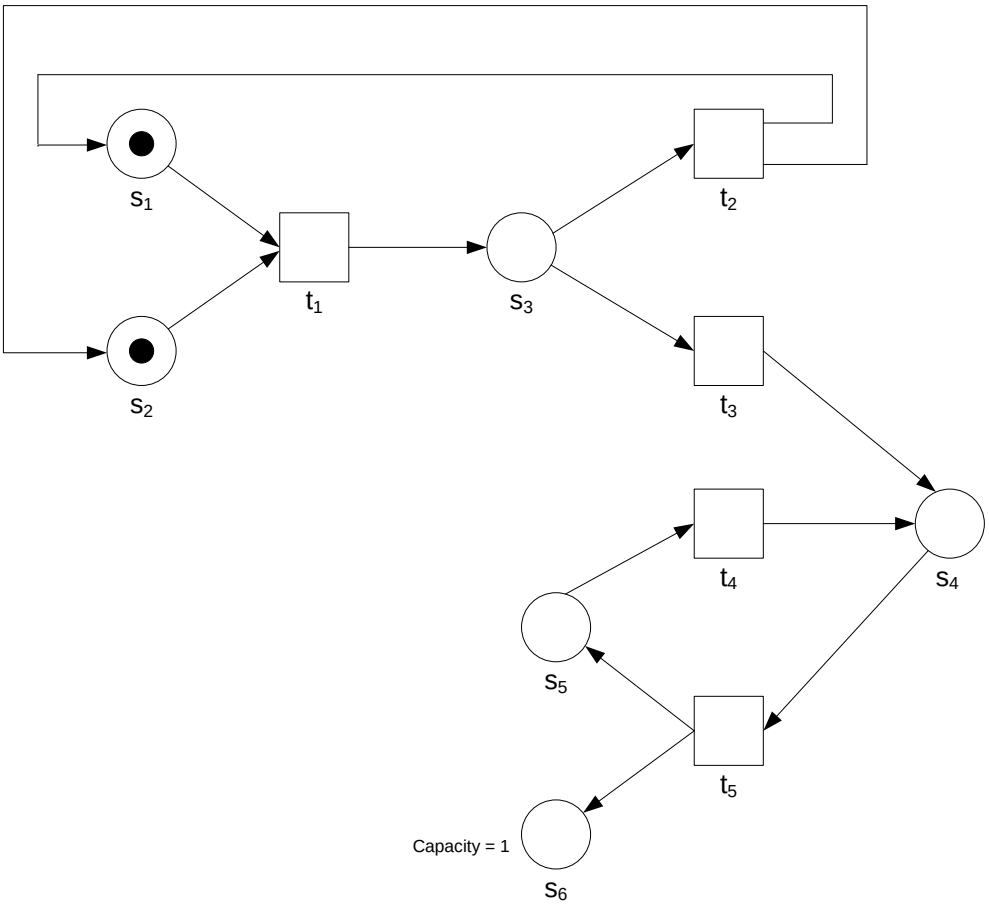
Question 4d (4 points)

d) Insertion of the transition I → D.

Remark: Insertion of I → D would lead to a cycle in the net. Consequently, the net would be not deadlock-free.

Question 5 (24 points)

Consider the following Petri Net:

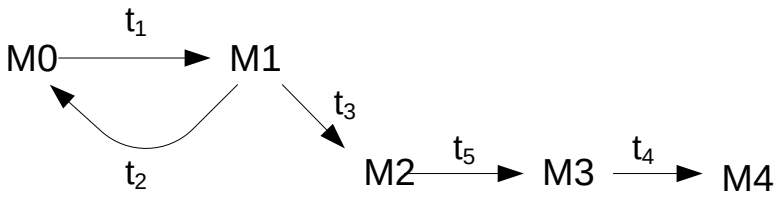


Question 5.a (10 points)

Reachability analysis:

	S1	S2	S3	S4	S5	S6	
M0	1	1	0	0	0	0	t1 > M1
M1	0	0	1	0	0	0	t2 > M0 ; t3 > M2
M2	0	0	0	1	0	0	t5 > M3
M3	0	0	0	0	1	1	t4 > M4
M4	0	0	0	1	0	1	Deadlock

Question 5.b (4 points)
Reachability graph (cf. Question 2a):



Question 5.c (6points)

This Petri Net contains a deadlock!

Explanation: When reaching marking M4 no transition can fire anymore. This can be also directly derived from the reachability graph since node 'M4' has not outgoing arc.

Question 5.d (4 points)

If the capacity for place s_6 is changed to ∞, transition t5 (and t4) may fire arbitrarily often.

In particular, no deadlock occurs and the set of reachable states is indefinite. Each time transition t5 fires a token will be added to place s6.

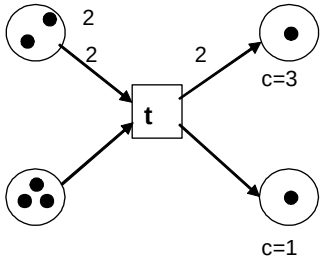
Set of reachable markings (this part is optional):

{(1,1,0,0,0,0), (0,0,1,0,0,0), (0,0,0,1,0,0), (0,0,0,0,1,1), (0,0,0,1,0,1), (0,0,0,0,1,2), (0,0,0,1,0,2), (0,0,0,0,1,3), …}

Question 6 (12 points)

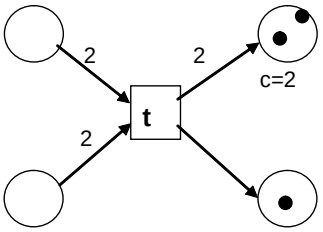
a) (4 points)

t cannot fire since the maximal capacity (c=1) of the lower output place is already reached



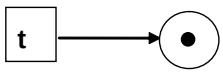
b) (4 points)

t can fire. Resulting net:



c) (4 points)

t can fire.
Resulting net:



PART II (Multiple choice questions)
(Each question in this part is 3 pts)

Answer Q1: c, see comparison table TQM/BPR on slide 24 in lecture 2. Significant redesign is typical for BPR.

Answer Q2: d, as indicated in slide about the definition of BPM systems (lecture 2)

Answer Q3: d, as described in the BPR definition and in the graph in the summary slide (p. 26, lecture 2).

Answer Q4: d

Answer Q5: c, event is a concept which is not present in

BiZZdesigner. However, the trigger may partially embody the idea behind an "event". The concept of event is central to other modelling approaches such as ARIS and BPMN.

Answer Q6: b. As indicated in the guest lecture from BiZZdesign– see slide 35.

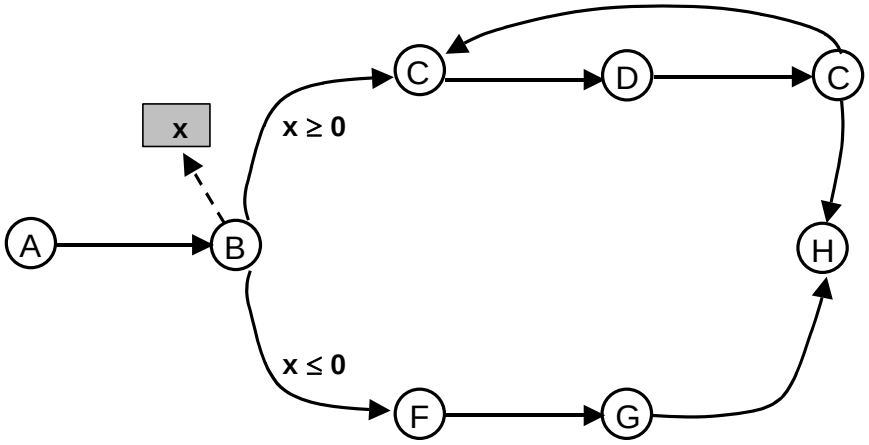
Answer Q7: b – The activity "taxeren" is never triggered. Consequently, the process will never pass the and–join.

Answer Q8: c. This is a quantitative technique. For identifying CSFs qualitative techniques are typically applied.

Answer Q9: c. For a,b,d COPAFIJTH has been mentioned as possible technique (see slides lecture 4 and 5). C could be resolved with quantitative techniques and simulation techniques.

Answer Q10: f – impact of change and risk analyses are inputs of the redesign phase and not goals.

For the following two questions consider workflow schema S (modeled in terms of an Activity Net):



Question 11.

Workflow instances running on schema S will …

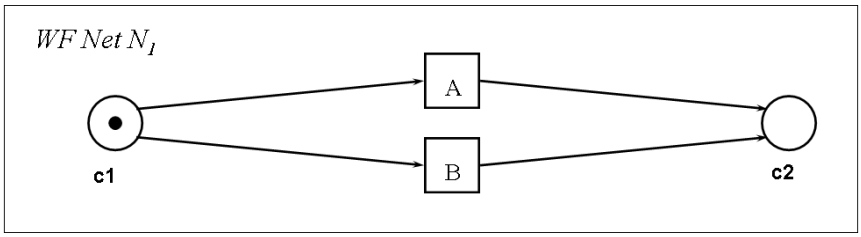
a) **always run into a deadlock.**
b) never run into a deadlock.
c) only run into a deadlock if x > 0 holds (when completing B)
d) only run into a deadlock if x = 0 holds (when completing B)

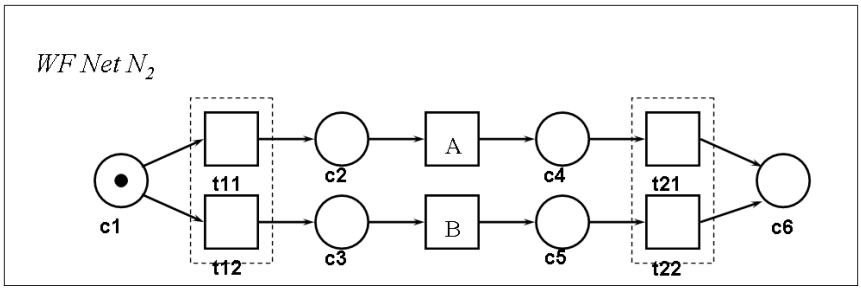
Question 12.

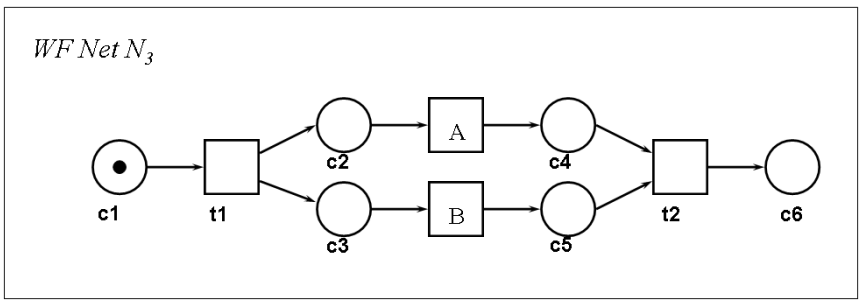
Which activities will be <u>always</u> completed for an instance running on S:

a) activities A, B, and H
b) activity A
c) **activities A and B**
d) activities A, B, C, and H

For the next three questions consider the following Workflow Nets N_1 – N_3:







Question 13.

Which of the following statements is true?

a) In net N_1, activities A and B may be concurrently executed (i.e., be worked on in parallel)!
b) In net N_2 activities A and B may be concurrently executed!
c) In net N_3 activities A and B may be concurrently executed!
d) In none of the three nets, activities A and B may be concurrently executed.

Question 14.

Consider the workflow net N_2. Which of the following statements is true?

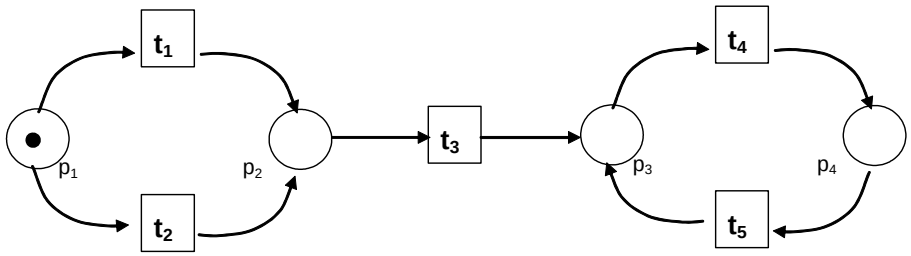
a) In the initial marking of N_2, only Activity t11 is enabled.
b) In the initial marking of N_2, only Activity t12 is enabled.
c) In the initial marking of N_2, both Activity t11 and Activity t12 are enabled.
d) In the initial marking of N_2, neither Activity t11 nore Activity t12 are enabled.

Question 15.

Consider the workflow net N_3. Which of the following statements is true?

a) In each reachable state at most one place contains a token.
b) In each reachable state at least one place contains a token.
c) In each reachable state exactly one place contains a token.
d) In each reachable state exactly two places contain a token.

For the next question consider the following Petri Net!



Question 16.

Which of the following statements is not true?

a) Transition t_1 can fire at most once?
b) Transition t_2 can fire at most once?
c) Transition t_3 can fire at most once?
d) Transition t_4 can fire at most once?

Question 17.

Consider the worklist handler component of a workflow management system? Which of the following statements is not true?

a) For a particular workflow instance `I` at most one work item exists at a certain point in time.
b) For a particular workflow instance `I` multiple work items related to the same workflow activity may exist at a certain point in time.
c) For a particular workflow instance `I` no work item may exist at a certain point in time.
d) For a particular workflow instance `I` multiple work items related to different workflow activities may exist at a certain point in time.

Question 18.

Consider the workflow reference model as suggested by the WfMC. Which of the following statements is not correct?

a) The workflow reference model provides interfaces which allow workflow enactment services to interact with each other.
b) The workflow reference model provides interfaces for implementing worklist applications.
c) The workflow reference model provides interfaces for accessing audit trails.

d) The workflow reference model provides interfaces for the migration of workflow instances to a new workflow model version.

Question 19

Which of the following items does not constitute a runtime task of a workflow management system:

a. Maintaining an audit file or log for workflow enactment
b. Creating and starting new workflow instances
c. Monitoring the progress of ongoing workflow instances
d. Checking a workflow model for the absence of deadlocks

Question 20

Which of the following kind of data is usually not generated and maintained by a workflow management system?

a. process audit data
b. process relevant data
c. control data
d. application data