Examination: 20302 **WT 2012/2013**

Name: _____

Matriculation no. _____

Faculty: _____

Exam: **Supply Chain Coordination**

Examiner: **Prof. Dr. Karl Inderfurth**

Grade: _____

Signature: _____

Permitted aids: Non-programmable pocket calculator, in accordance with the regulations of the faculty's examination office; English (or English to X / X to English where X is any other language) dictionary (book, not electronic) without any handwritten entries.

Instructions:

- For calculations and answers please use this examination booklet. In case the provided space is not sufficient, use page 2 of the booklet and clearly indicate the respective assignment number.
- The examination comprises four assignments with each assignment accounting for 30 points. **Assignment 1 is mandatory**. Additionally, two out of assignments 2-4 are to be solved. In case all these assignments are solved, assignment 4 will be ignored. The maximum number of points is 90.
- Please answer in English (students from German speaking study programs are allowed to answer in German) and do not use pencils for your entries.

Only for the examiner!

Assignment	1	2	3	4	Total
Points					

Calculations:

Assignment 1: True or false ? **(30 points)**

For a correct answer you are awarded 2 points. False or no answers yield 0 points.

	true	false
In a coordinated supply chain all actors yield a higher profit than in an uncoordinated supply chain.	☐	☐
From a process view of a supply chain, the customer order cycle is always a pull process.	☐	☐
Barilla experienced the bullwhip effect due to frequent price promotions on their products.	☐	☐
In practice, the bullwhip effect often is enlarged by the production smoothing effect.	☐	☐
The bullwhip factor under non-stationary autoregressive demand is influenced by the demand's coefficient of correlation.	☐	☐
Under action field [1] (retail pricing) the buyer's locally optimal retail price p_B increases with the supplier's price p_S.	☐	☐
Under action field [2] (lot sizing) coordination of the supply chain is not achieved with a wholesale price contract because the buyer's locally optimal lot size is too large.	☐	☐
A buyback contract can achieve coordination under action field [1] (retail pricing).	☐	☐
A two-part tariff can be used to achieve coordination in action field [2] (lotsizing).	☐	☐
In action field [4] (capacity planning) the simple wholesale price contract results in a too high level of capacity acquisition to achieve coordination.	☐	☐
When coordination is enabled in action field [3] (ordering and safety stock planning) an equal split of profits between the actors is always possible.	☐	☐
When a volume-based quantity discount contract is applied to achieve coordination in action field [3] (ordering and safety stock planning), information on demand realization is not needed to implement this contract.	☐	☐
The critical ratio which determines the globally optimal order quantity in action field [3] (ordering and safety stock planning) does not depend on the salvage value.	☐	☐
A revenue sharing contract in action field [3] (ordering and safety stock planning) can only coordinate the supply chain if the buyer receives at least 50% of the total supply chain profit.	☐	☐
Contracts with signaling and screening in supply chains with asymmetric information usually do not coordinate the supply chain.	☐	☐

Assignment 2 **(30 points)**

Describe how conflicts of interest can cause coordination deficits in decentralized supply chains. Start by explaining what is meant by a coordination deficit.

In which of the 4 action fields introduced in the teaching material do incentive-based coordination deficits exist and why? Describe generally how contracts can be used to overcome such conflicts of interest!

Name one contract for each of the 4 action fields that achieves coordination and explain its characteristics briefly!

Assignment 3 **(30 points)**

Assume a two-stage supply chain according to action field [2] with a buyer B and a supplier S. The buyer faces a constant demand rate R and orders in lots from the supplier. Fixed costs for ordering are f_B; per ordered unit the buyer pays the wholesale price p_S and a processing cost c_B. Holding units costs h_B per unit and time unit. The buyer receives the retail price p_B per unit he sells to the end customer. The supplier incurs fixed costs per production run of f_S and a per unit cost c_S. She delivers just-in-time to the buyer.

(a) How much does B order if he wants to maximize his own profit? (without coordination)

(b) How much does B order if he wants to maximize overall supply chain profit? (optimal coordination) Please, provide both actors' profit functions.

(c) Describe an order-based quantity discount contract that S should offer to B which ensures supply chain coordination. Derive formulas for the transfer function, the price discount function, the break point and the constraints for incentive compatibility for B as well as the constraints for participation of S and B.

Assignment 4 **(30 points)**

Analyze the revenue sharing contract for order quantity and safety stock planning in a two-stage supply chain with stochastic demand (action field [3]).
Use the common supply chain notation with c_S, c_B, p_S, p_B, O_B, R and the functions $\varphi(\cdot)$, $P_S(\cdot)$, $P_B(\cdot)$ and $P(\cdot)$.

(a) Specify the transfer function $T(O_B, p_S, \beta, R)$.

(b) What values do the contract parameters p_S and β have to take in order to coordinate the supply chain?

Hint: Use the contract construction scheme: $P_B^T(O_B, p_S, \beta) \overset{!}{=} \gamma \cdot P(O_B)$

(c) Derive the profit functions of both actors if B only shares the revenue from regular sales but not from salvaging excess units.