

This is a list of possible examination questions based on the course materials including **lecture slides** and **Pricing Communication Networks** (Courcoubetis, Weber). Note that also questions not listed here are possible in the exam.

Explain the following terms and concepts

- Network externality, network effect
- Sarnoff's Law, Metcalf's Law, Reed's Law
- Price, charge, tariff
- Incentive compatible tariffs, congestion pricing
- Utility function, consumer surplus, producer surplus
- Marginal utility, marginal cost, marginal cost pricing, Ramsay pricing
- Demand function, aggregate demand function, inverse aggregate demand function
- Cross-elasticity, substitute, complement
- Tatonnement
- Price taker
- Services-based competition, facilities-based competition
- Principal-agent problem
- Walrasian equilibrium, Nash equilibrium, Pareto efficiency
- Price discrimination, service differentiation, bundling
- Lock-in, switching cost
- Fully distributed cost, stand-alone cost, long-run incremental cost, LRIC+
- Internet service providers: peering agreement, transit agreement
- Calling-party's-network-pays, bill-and-keep
- Allocative efficiency, productive efficiency, distributive efficiency
- Total surplus subsidy mechanism, incremental surplus subsidy mechanism
- Dynamic price cap regulation, tariff-basket regulation
- EU regulation: relevant market, significant market power
- Condominium fiber model
- English and Dutch auctions, optimal auctions, simultaneous ascending auction
- Auction: winner's curse, free-rider problem, exposure problem

Consumers

- Explain schematically the consumer's problem in terms of utility function, product price, and producer's product cost.
- How can you apply reversal theory (by Michael Apter) on classifying mobile entertainment services?
- Assume a market with positive network effects and N potential customers ($N=100$) indexed by $i = 1 \dots N$. Willingness to pay of customer i is $u_i(n) = n_i$ for a unit of good given that n other customers will be using it. Customers can always return the good and get refund if the price goes below utility. Assume price $p=900$ posted. Calculate the possible equilibrium points and define conditions for reaching them. Define the socially optimal point and conditions for reaching it.

Enterprises

- Describe a generic telecom purchase process of enterprises, based on request for proposals (RFP).
- Calculate the total cost of ownership for terminal types in an enterprise (a cellular handset, personal computer). Which is most expensive? Why?

Operators

- Describe the value network around operators by drawing a diagram of the business roles and the relationships between the roles.
- Identify different types of virtual mobile network operators in the Finnish market.

Pricing

- What is the price level that regulator aims at? Why?
- What is the price level that a monopolist aims at. Why.
- Under what conditions does tatonnement converge to a market equilibrium.
- How can the operator reduce the problems related to flat-rate pricing.
- Define the pros and cons of pricing based on Long-Run Incremental Cost.
- Why is it possible that the consumer and social surplus get maximized at the same Nash equilibrium point in congestion pricing. Demonstrate mathematically.
- What does price discrimination mean and what are the three required conditions for price discrimination to take place?
- What is the problem of flat-rate pricing from the social surplus point of view? Demonstrate analytically.
- What do private and public goods mean? What are the main differences between these goods? Give some examples of both private and public goods from the telecommunications perspective.

Charging and billing

- Explain schematically the on-line credit card transaction process for Internet electronic commerce payments.
- Explain schematically the payment transaction process for mobile digital content in superdistribution
- Explain schematically the charging and billing process and subsystems of a typical mobile operator.
- How can a mobile operator reduce the production cost of payment transactions based on operator's charging and billing machinery.

Investments

- Explain Net Present Value, Internal Rate of Return, and Payback time. Why are all the three meters needed to assess the value of an investment.
- Explain capital expenditure and operational expenditure. How are they treated in cash flow analysis?
- Consider WiMAX technology as a fixed broadband operator's investment problem. Define schematically a techno-economic model for analyzing the WiMAX business case. What are the critical success factors of WiMAX?

Interconnection

- Explain the prevailing types of pricing agreement for transit traffic in Internet.
- What factors are affecting transit pricing in Internet.
- Explain the interconnection charging mechanisms of mobile networks.
- Compare transit and peering contracts in Internet.
- Explain the structure and evolution of the global Internet interconnection ecosystem
- What is the impact of content delivery networks (CDN) on Internet structure
- Describe the current business model of the Finnish Internet Exchange Ficix.

Roaming

- Describe schematically the GRX-based charging model for roaming traffic between GPRS operators.
- Compare the typical roaming models of GPRS and WLAN

Regulation

- List the principles of effective regulation.
- Explain the three types of efficiency criteria for an economy.
- Explain different mechanisms for price regulation of monopolies
- What kind of reference costs can be used in dynamic price cap regulation
- Describe the EU regulatory process schematically
- List the major regulatory milestones of the Finnish telecom market.
- What does the principal-agent problem mean? Give an example of the principal-agent problem in telecommunications.
- Demonstrate analytically how an agent with better information than the principal can achieve positive profits by hiding information and pretending being something else that she really is. How can the regulator fight against this problem?
- What are the possible setbacks in allowing bundling in Finland (allowed for 3G handsets since April 1, 2006)? What are the possible advantages of bundling from the social welfare point of view?

Competition

- Explain Porter's model for competition ("5 forces") and apply it for analyzing the market position of a virtual mobile network operator.
- What is the relevance of complementary assets in an innovator's market entry strategy.
- The present value of a customer to an operator equals her switching cost. Assume that operator has a variable monthly cost of 20 EUR per customer. Further, it costs a customer 80 EUR to switch from one operator to another. Supposing a monthly interest rate of 1%, what is the equilibrium price setting for a monthly subscription. At equilibrium, operators are profitable and customers don't have incentive to switch operators.

Spectrum management

- Explain the differences of UMTS spectrum auctions in the UK, the Netherlands, and Germany.

- What are the statistical indicators for predicting a government's desire for spectrum auctions.
- Explain how spectrum allocation and assignment are handled in the three basic spectrum management approaches?
- Explain the process of a simultaneous ascending auction.
- Using a numeric example explain the "free riding" problem of simultaneous ascending auctions.
- Using a numeric example explain the "incentive to delay bidding" problem of simultaneous ascending auctions.
- Using a numeric example explain the "inefficient allocation" problem of simultaneous ascending auctions.