

MTAT.03.244 – Software Economics
Regular Exam – 13 January 2015
Notes:

- The exam is open-book and open-laptop. Web browsing is allowed.
- You are not allowed to communicate with anyone during the exam in any way (except with the lecturer).
- You must submit your exam as a single “zip” or “rar” file using the “Submit” button in the course Web page. If you are unable to submit electronically, please ask the lecturer for a possibility to submit on paper.
- If you find that there is not enough information in the text below and you need to make additional assumptions, please write down your assumptions.

Task I. Warm-up: Multiple-choice questions (2 points each)
I.1

Income Statements for Group and Segments			
in € million			
	Note	Group	
		2013	2012 ¹
1	9	76,058	76,848
Cost of sales	10	-60,784	-61,354
2		15,274	15,494
Selling and administrative expenses	11	-7,255	-7,032
Other operating income	12	841	829
Other operating expenses	12	-874	-1,016
Profit/loss before financial result		7,986	8,275
Result from equity accounted investments	13	398	271
Interest and similar income	14	184	224
Interest and similar expenses	14	-449	-375
Other financial result	15	-206	-592
Financial result		-73	-472
Profit/loss before tax		7,913	7,803
Income taxes	16	-2,573	-2,692
3		5,340	5,111

What labels could be assigned to placeholders 1, 2 and 3 in the above figure?

- A. 1 – Sales, 2 – Gross Loss and 3 – Net Profit
- B. 1 – Revenues, 2 – Gross Margin and 3 – Net Profit
- C. 1 – Revenue, 2 – Gross Margin and 3 – Net Loss
- D. 1 – Goods Sold, 2 – Gross Margin, and 3 – Operating Income

I.2:

You received an analysis in which you found some numbers. Some of them had some errors and have to be redone. Which of the below alternative/alternatives are reasonable?

- A. NPV: 45%, IRR: 18%, ROI: 123%, Payback period: 2,4 years
- B. NPV: € 4,3M, IRR: 19%, ROI: €6,2M, Payback period: 3 years
- C. NPV: €2,9M, IRR: 19%, ROI: 83%, Payback period: 25 months
- D. NPV: € 5,7M, IRR: \$3,9M, ROI: 124%, Payback period: 2,1 years

I.3

_____ will tell you how much value in terms of amounts the investment will yield whereas _____ will show at what rate, your investment will yield a return that is the same as you invested (assuming you can reinvest the annual gains at the same rate of return).

- A. ROI / IRR
- B. Rate of Return / ROI
- C. NPV / IRR
- D. IRR / ROI

I.4

Payback periods are meaningful to calculate only when the calculated _____ do eventually outweigh _____.

- A. ROI / IRR
- B. Cash Outflows / Cash Inflows
- C. Project Benefits / Initial Investments
- D. Cash Inflows / Cash Outflows

I.5:

A large company is having some difficulties when it comes to investments in larger infrastructural IT projects. Last time they did such a project, many of the smaller branches, although their revenues were the same, had decreasing profitability. As the company stands to make a new infrastructural investment, they decided to change their funding policy for infrastructural IT projects. How was their funding policy and how is it now for infrastructural projects?

- A. Chargeback and Allocation
- B. Allocation and Budget
- C. Chargeback and Budget
- D. Budget and Allocation

Task II. Function-Point Analysis and Estimation [15 points]

Tartu-based shirt manufacturer Sangar (www.sangar.ee) is considering the option of expanding its online presence. Currently, Sangar's Web site offers standard e-shop functionality. The Web site allows customers to browse the catalogue of shirts sold by Sangar, to add shirts to the shopping cart and to check-out and pay online. Shirts are shipped to the designated address via postal services.

Sangar is now considering the possibility of manufacturing and selling customized shirts through their e-shop. Customers would be able to design customized shirts by selecting the fabric, the type of collar, type of cuff, buttons, etc. Customers would also be able to add a label (e.g. their name) to their shirt. This "mass-customization" functionality is already offered by international shirt retailers such as Blank Label.¹

The initial requirements for the order tracking application with customization functionality are:

1. The application should allow a customer to start a new shirt design
 2. The application should allow a customer to select the main fabric to be used for a given shirt, among a collection of available fabrics
 3. The application should allow a customer to select the type and the fabric of the shirt's collar
 4. The application should allow a customer to select the type and the fabric of the shirt's cuff
 5. The application should allow a customer to specify the style and the fabric of the shirt's pockets
 6. The application should allow a customer to specify the type of buttons for a shirt (e.g. thick buttons or thin buttons)
 7. The application should allow a customer to specify whether or not they want to add a "monogram" or a "label" in their shirt (e.g. to write down their name in a corner of the shirt)
 8. The application should allow a customer to specify the collar size, the sleeve length and the fit preference (slim or classic)
 9. The application should allow a customer to create a user account
 10. The application should allow a customer to save a given shirt design (whether complete or partial) and to retrieve it later when they log in to their account.
 11. The application should allow a customer to add a "customized shirt design" to their shopping cart and to specify how many units of that shirt they want
 12. The application should allow a customer to checkout, using the same checkout system already available in the existing sangar.ee e-shop.
 13. Throughout the customization process, the application should display the shirt that the customer is designing. For example, when the customer specifies the fabric, the image of the shirt is updated accordingly.
- a) Give an estimate of the number of unadjusted function points of the new system. Do not count requirements 12 and 13 in your estimate. Requirement 12 is covered already by the existing e-shop system, while requirement 13 will be fulfilled using

¹ A short demo of BlankLabel's customization feature can be found between minutes 1:10 and 1:40 of this video: <https://www.youtube.com/watch?v=e5CIdoQgBQ0>

an image processing tool that Sangar would purchase separately. Please write your FP estimate using Brett Broschma's FP workbook.

- b) Give a Cocomo II estimate of the cost required to develop the functionality of the new shirt customization system. You should justify each cost driver/scale driver that you set to a value other than "nominal". Assume a cost per person-hour of EUR 50.

Task III. Software purchasing decision [10 points]

The business development team of a company is about to purchase a modeling tool. After an initial market assessment, two tools have been shortlisted. Both tools have rather equivalent functionality given the company's requirements. However, they come with very different pricing models:

- **Option A:** Requires purchasing (at EUR 1500) a perpetual license without usage restrictions (i.e. any number of users). The tool would run on an in-house server with an upfront cost of EUR 2500 plus an annual operation cost of EUR 1000.
- **Option B:** Is offered as a SaaS tool at EUR 290 per user per year.

In the first year, 5 people in the company will use the tool in question. From years 2 onwards, there will be 8 users.

- a) Compare the above options based on their NPV over a 5-years timeframe using discounted cash flow analysis. Assume a discount rate of 15%. Note that the NPVs will be negative as we only consider costs, not benefits.
- b) In addition to NPV, which other criteria (e.g. risks and benefits) should be considered when comparing options A and B. We expect a short answer – for example, write your answer in the form of 2-4 short statements.

Task IV. Technology Investment Analysis [25 points]

A car manufacturer is investigating if it would be a good investment to use their competitive advantage in advanced motor technology and car manufacturing to start building light airplanes.

The company made a feasibility study and concluded that they could target regional airlines as customers, selling to them airplanes with passenger capacity of between 70 and 90. The total demand for such airplanes is estimated to constant at about 1000 airplanes a year for at least the coming 5 years. With a list price of 250€ (all numbers are x10000 but for simplicity, use the given number format) per plane, they believed they would be able to get 40% market penetration. Naturally, some would request a more luxurious version of the airplane. It is estimated that 15% of the sold planes would be equipped with the

extra package for an average price of 50€. Once the planes had been sold, they also expected to sign service and maintenance contract for 60% of the revenues of planes sold (including extra package). The value (revenue) from service and maintenance is estimated to be 6%.

The cost of manufacturing the planes is estimated to be 30% of the list price. The equivalent number for extra package is 50% and for service and maintenance, it is 60%. The annual marketing cost is estimated to be 400€ and other costs will be 600€.

The R&D needed for developing the new planes will be 10 000€ upfront and 9 000€ in year 1. The actual construction of the first plane is estimated to cost in total 40 000€ of which 25 000€ is in year 1. The tests needed will cost 5 000€ initially and then 15 000€ in the first year. The investments in the infrastructure needed, will be of 20 000€ and 15 000€ (upfront and year 1). Once the factory is operational, the annual costs will be 5000€. First sales will begin in 2016.

- a)** Assuming an investment period of 2014 as upfront and five full years (ending with 2019), and a discount rate of 25 %, what are the NPV, IRR and ROI of this investment? In which year, will the investment pay itself back?
- b)** Let us assume (all other things equal), that they could increase their market penetration with 10 % by offering a discount of 13 % during the investment period. Would this measure improve the NPV, IRR and ROI (present your numbers as well)?