

# 1.264 Lecture 3

## Time and resource estimation

Next class: Read chapters 7, 8. Hand in exercise solution after class  
Form groups for homework.  
Hand in today's exercises on paper.

# Choose system implementation goal

- **Product, time, cost: you can lock 2 of the 3**
- **What do you need? Examples (not exhaustive):**
  - **High certainty in meeting a schedule constraint**
    - If schedule is fixed, either product or resources are fixed but not both
  - **Runaway prevention (with bad past history)**
    - Low level of process maturity, recovery mode
  - **Predictability (tied to budget, other programs)**
    - Staff and schedule are fixed. Product must flex.
  - **Lowest cost**
    - Requires good people, good process
  - **Desire for free overtime (startups, cheap companies)**
- **These are not the same problem**
  - **Choose a method appropriate to the problem**
    - Tables next time: fastest possible, most efficient, nominal

# Exercise

- **What do you need?**
  - **Change from uniform to regional assortments in retail supply chain in a large retailer**
  - **Sourcing key inputs from new overseas suppliers for holiday season**
  - **Implementing a new bus location system for a public transit agency that displays on smart phones and PCs**
    - **There have been many failures in the past.**
  - **Implementing electronic health records at a large hospital**
- **Take 10 minutes:**
  - **Recommend a goal**
  - **List top 3 factors or key unknowns to be researched early in the decision**

# **Solution (one of many)**

- **What do you need?**
  - **Change from uniform to regional assortments in retail supply chain in a large retailer**
    - **Lowest cost**
  - **Sourcing key inputs from new overseas suppliers**
    - **High certainty in meeting schedule**
  - **Implementing a new bus location system for a public transit agency that displays on smart phones and PCs**
    - **Runaway prevention**
  - **Implementing electronic health records at a large hospital**
    - **Runaway prevention. Difficult to tell doctors what to do.**

# Estimation

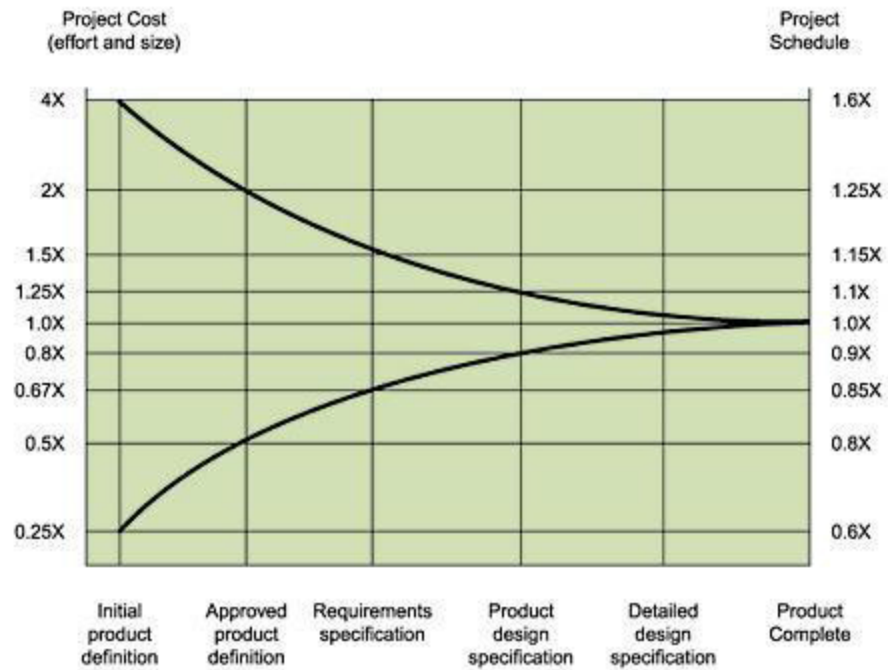


Image by MIT OpenCourseWare.

# Estimation steps: software example

- **Estimate size of project:** (product)
  - Methods/behaviors (formerly function points) to be configured, modified, written and/or implemented
  - Lines of code: depends on language, tools (technology)
- **Estimate effort (person-months)** (process/people)
- **Estimate schedule (calendar-months)** “
- **Estimate team size as (person-months / calendar-months)**
  - This is just algebra. Team size is not an independent variable.
- **Provide estimates in ranges and refine for increasing precision as project progresses**
  - Never give a point estimate
  - Use the convergence curve
- **This process is also used for non-software projects**
  - Non-software metrics harder to find. Track your own.

## **Project size estimation (product)**

- **Count:**
  - **Inputs: Web pages, forms, messages from other systems, XML documents**
  - **Outputs: Web pages, reports, graphs, messages, XML documents**
  - **Inquiries: simple Web inputs, generally producing a single output**
  - **Logical internal files: tables or files in own database**
  - **External interface files: tables or files used from other systems or databases**

# Method (function point) multipliers

## Function-Point Multipliers

Program Characteristic	Function Points		
	Low Complexity	Medium Complexity	High Complexity
Number of inputs	X 3	X 4	X 6
Number of outputs	X 4	X 5	X 7
Inquiries	X 3	X 4	X 6
Logical internal files	X 7	X 10	X 15
External interface files	X 5	X 7	X 10

Image by MIT OpenCourseWare.



# Effort estimation (method/function point example)

## Example of Computing the Number of Function Points

Program Characteristic	Function Points		
	Low Complexity	Medium Complexity	High Complexity
Number of inputs	$6 \times 3 = 18$	$2 \times 4 = 8$	$3 \times 6 = 18$
Number of outputs	$7 \times 4 = 28$	$7 \times 5 = 35$	$0 \times 7 = 0$
Inquiries	$0 \times 3 = 0$	$2 \times 4 = 8$	$4 \times 6 = 24$
Logical internal files	$5 \times 7 = 35$	$2 \times 10 = 20$	$3 \times 15 = 45$
External interface files	$9 \times 5 = 45$	$0 \times 7 = 0$	$2 \times 10 = 20$
Unadjusted function-point total			304
Influence multiplier			1.15
Adjusted function-point total			350

Image by MIT OpenCourseWare.

# Influence multipliers

- Data communications
- Distributed processing
- Heavy use
- Performance
- Transaction rate
- Online data entry
- End user efficiency
- Online update
- Complex processing
- Reusability
- Installation ease
- Operational ease
- Multiple sites
- Facilitate change

Rate each element from 0-5

Influence multiplier is  $0.65 + 0.01(\text{sum of elements})$ ,  
varies between 0.65 and 1.35

# Effort estimation: lines of code (technology)

Language	Level	Statement per Function Point
Assembler	1.0	320
C	2.5	125
C++	6.5	50
AWK	15.0	25
Perl	15.0	25
Lisp	5.0	65
Ada 83	4.5	70
Pascal	3.5	90
Focus	8.0	40
Oracle	8.0	40
Sybase	8.0	40
Paradox	9.0	35
Modula 2	4.0	80
dBase IV	9.0	35
Fortran 77	3.0	110
GW Basic	3.25	100

Cont....

Language	Level	Statement per Function Point
Quick Basic 3	5.5	60
Visual Basic 3	10.0	30
Cobol (ANSI 85)	3.5	90
Macro assembler	1.5	215
SAS, SPSS, other statistics packages	10.0	30
Smalltalk 80; Smalltalk/V	15.0	20
Excel, Lotus 123, Quattro Pro, other spreadsheets	≈ 50	6

Approximate Language Levels

# Exercise

- **If you had a requirements document with:**
  - 10 Web input pages,
  - 15 output pages (reports),
  - 20 (internal) database tables, and
  - no inquiries or external files,
- **How many function points would it contain?**
  - Assume medium complexity for each page, report, table
  - Assume influence multiplier = 1.0
- **Technology:**
  - If you wrote the system in C, how many lines of code would it have?
  - What if you used perl (a simpler scripting language)?
  - If you could do it in perl instead of C, would you?
- **How do you decide what technology to use?**

# Solution

- **If you had a requirements document with 10 Web pages, 15 reports, 20 database tables, and no inquiries or external files, how many function points would it contain?**
  - Assume influence multiplier = 1.0
  - About 315 function points, if each item is medium complexity
- **If you wrote the system in C, how many lines of code would it have?**
  - About 40,000 lines of C
  - What if you used perl?
    - About 8,000 lines of perl
- **If you could do it in perl instead of C, would you?**
  - Yes. The system is 20% the size and will take <20% of the resources to write (scale diseconomies)
- **How do you decide what technology to use?**
  - The one that is capable enough to solve the problem and yields the fewest lines.

## Hand in

- **Upload your answers to the goals and resource estimation exercises**
  - **On paper. Make sure your name is on it. You may hand in one for your group. Or...**
  - **Upload to course Web site, in Word, Notepad, or any other common format**

MIT OpenCourseWare  
<http://ocw.mit.edu>

1.264J / ESD.264J Database, Internet, and Systems Integration Technologies  
Fall 2013

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.