

**Business Studies for
Computer Scientists,
or
"How to Start and Run a
Company"**

A course of 12 lectures

Jack Lang

Introduction

History of Lab and spin-offs – The
Cambridge Phenomenon

Programming only a small part of success

Outline Synopsis

1. So you've got an idea...
2. Money and Tools for it's management
3. Legal aspects, contracts and copyright
4. People: How to organise a team
5. Project planning and management
6. Quality, maintenance and documentation
7. Marketing and Selling
8. Growth and Exit routes

In addition to the above, four Guest Lectures will be organised

Reading list

**Jack Lang “Essentials of Enterprise”
FT.COM/Prentice Hall.**

To be published in September

Reading list

Brooks F. : The Mythical Man Month
ISBN 0201006502 Addison-Wesley

Geoffrey A Moore
Crossing the Chasm
ISBN 0-8870-519-9 Harper Business 1991/5
Inside the Tornado
ISBN 1-900961-58-X Capstone 1998
(The Gorilla Game)

Eric S Raymond: The Cathedral and the Bazaar
ISBN 1-56592-724-9 O'Reilly 1999

Townsend, R. : Up The Organisation
ISBN 0340149868 Hodder Fawcett 1971
2nd Edition: Further Up the Organisation,
now sadly out of print,

Reading list 2

Dyson J.R. : Accounting for Non-Accounting Students
ISBN 027360435X Pitman 3rd ed 1994

Microsoft Project
Microsoft Excel

Niblett B. : Legal Protection of Computer Programs
ISBN 085120 097
Oyez Publishing Company

Keenan, D: Business Law
ISBN 0273601148 Pitman

Buckle: Managing Software Projects
ISBN 0354040677 Macmillan

Reading List 3

Drucker P.F: Innovation and Entrepreneurship
ISBN 033294652 Pan

Weinberg, G.M.:The Psychology of Computer Programming
ISBN 0442292643 Van Nostrand

William D Bygrave, Editor
The Portable MBA in Entrepreneurship
ISBN 0-471-16078-4 John Wiley 2nd edition 1997

Guidelines for Directors
ISBN 090093980X
Institute of Directors

The Cambridge Phenomenon
ISBN 095102020 Segal Quince and Partners

Reading List 4

Nokes: Startup.com FT/Prentice Hall ISBN 0-273-65091-2

WallStreet.com Andrew D Klein (founder of Wit Capital); Henry Holt ISBN 0-8050-5758-7 1998

Everett M Rogers; Diffusion of Innovation, 4th Edition Free Press, New York 1995 ISBN 0-02-926671

Paul A Samuelson, William D Nordhaus Economics 16th Edition McGraw Hill ISBN 0-07-115542-2

<http://sol.brunel.ac.uk/~jarvis/bola/index.html>

<http://www.delphion.com/> (was the IBM patent search site)

<http://www.patent.gov.uk/> UK Patent office

<http://www.digitalpeople.org>

<http://www.firsttuesday.co.uk>

<http://www.tallaght.com/lawyer/commercial/director/>

<http://www.collyer-ristow.co.uk/news-publications/summary-of-directors-duties1.htm>

<http://www.jordans.co.uk/>

<http://www.virginia.edu/~career/handouts/interview.html>

ISO 9000:2000 available from <http://bsonline.techindex.co.uk>, as is

BS 7799-2:1999 Information security management.

1. So you've got an idea...

Introduction

Why are you doing it?

**What is it? defining the product or service;
types of company**

**Who needs it? an introduction to market
analysis**

How? Writing the business plan

**Futures: some emerging areas for new
computer businesses**

Why are you doing it?

Motivation: fun or profit?

Life style or high growth?

Size

Why now?

Why me?

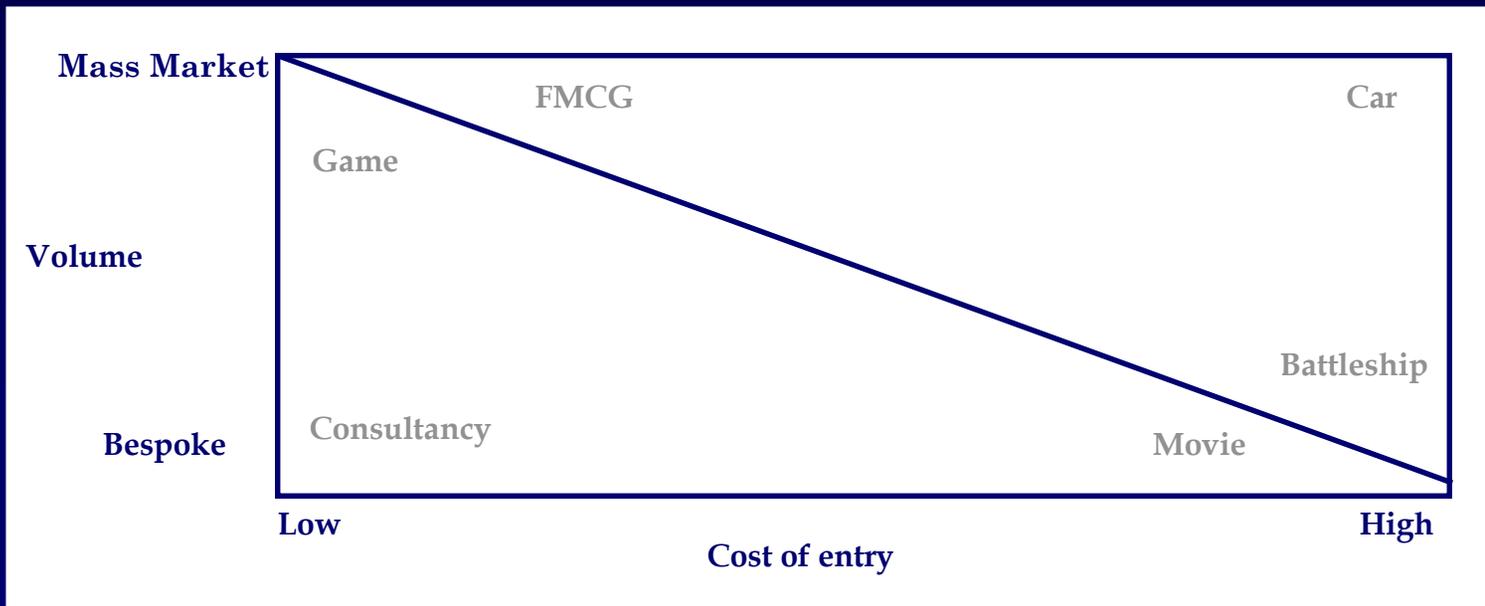
- Barriers to market entry
- Barriers to competition
- Unique advantages

What is it?

Technology driven / market pull

Product or service

Specialist or mass-market



How? Writing the business plan

- Business plan describes what you want to do
- BVCA Handbook
- KISS: Keep It Simple and Stupid!
- Write for the target audience

- Business Plan Competitions – Cambridge £1k and Cambridge £30K
 - Cambridge University Entrepreneurs Society (CUE)
 - www.cue.org.uk

VC Criteria

- **Global sustainable under-served market need**
- **Defensible technological advantage**
- **Strong management team**
- **Believable Plans**
- **60% IRR**

Market Need

- **Who needs it?**
 - **Why?**
 - **Alliances**
 - **Distribution routes**
 - **Branding**
- **Growing market**
 - **Global potential**
- **Under served need**
 - **Competition**
 - **What do they do now?**
- **Sustainable**

Who needs it?

FAB: Features Advantages Benefits

- Feature:
 - This program runs really quickly
- Advantages:
 - Less waiting time
 - Uses less resources
- Benefits:
 - Less frustration
 - You can get more done
 - Cheaper to run

USPs: Unique Selling Points

Market Research

Defensible technological advantage

- IPR
 - Patent
 - Copyright
 - Trademark
- Defensible technological leadership
 - against well-funded competition
 - Niche Market share

Strong management team

- You can't do it all by yourself
 - “Small” project >10 person-year
 - Team building
 - 1:3:10 rule
- Alliances
- Recruit experience
 - Financial Director
 - Sales & Marketing
- Training & experience
 - Merchant bank/Management Consultancy
 - MBA

Believable Plans

- **Business Plan**
- **Development Plan**
- **Marketing plan**
 - Adverts, mail shots, web-sites
- **Sales Plans**
 - Distribution, Direct Sales
- **Quality Plans**
- **Financial Projections**
 - Budget
 - 60% IRR
 - Pay back financing in third year
 - Cash flow

Key Points

- **Market**
 - Who needs it?
 - How will they buy it?
- **Team**
 - Experience, Motivation, contracts
- **Technology**
 - IPR: Exclusive
 - Believable development?
- **Finance**
 - How much?
 - Sources

Futures: some emerging areas for new computer businesses

- **Pace of change: Factor of 2 every 2 years**
- **About 10 years from Lab to mass product**
- **We can predict the near future (10 years)**
 - **Futures: Processor performance**
 - **Comms: 100,000 bandwidth cost reduction**
 - **Multi media and moving pix; digital TV; 3-D models**
 - **1000 MIP, 100Gbyte, photo realistic moving graphics, video mail, 100Mb/sec WAN, world-wide knowledge base,**
 - **Home networks;**
 - **UMTS – ubiquitous access**

The Trillion Dollar Market

- Effect of electronic commerce
- Customer pull, not advertising push
- Merging of computing, entertainment, communications
 - Games now gross more than films

Internet Commerce

- **Works for**
 - Established Brands
 - Specialist goods
- **60% of accesses are to adult content**
 - Driven factor: Hidden agendas
 - Communities of interest
 - Mostly male - men look at porn, women shop
 - Wide age range
- **Don't believe the hype**
 - Most internet ventures not profitable unless adjunct to existing business
 - Advertising model (mostly) doesn't work
 - Micro payments don't work

Predictions

- **Microsoft/Intel will remain dominant**
 - Other chip manufacturers will continue to struggle
 - UNIX will remain specialist
 - Java will be increasingly minority interest
- **Internet/ WWW will dominate**
 - AOL, CompuServe, E-world, Microsoft Network will become internet service suppliers
- **Differentiation**
 - “Lean forward” or 3-foot experience
 - Study box - user pull
 - “Lean back” or 10-foot experience
 - Internet TV
 - Passive Couch mouse; server pushed experience

More Predictions

- **Game machines will become PC based**
 - Continue to lead low-cost graphics technology
 - Networked
 - VR
- **Video-on-demand specialist market only**
 - Hotels, airplanes, BUT Internet TV widespread
- **No new major applications**
 - possibly
 - personal communications
 - unified messaging
 - personal money management
 - Home shopping

Watch Points - a personal list

- Internet and Digital TV
- Freenet (<http://freenet.sourceforge.net/>)
- Intelligent agents (e.g EPG)
- PDA's/ Cell phones - what personal systems we will all be carrying?
 - WAP
 - UMTS
- Dragon Voice recognition
 - Wristwatch systems
- Embedded and SoHo systems
 - Luxury cars now have more compute power on-board than the moon lander
 - Home networks

2. Money and Tools for it's management

- **Introduction to accounting**
 - Profit and Loss
 - Cash flow
 - Balance Sheet
 - Budgets
- **Sources of finance**
- **Stocks, Shares, Futures and Options**

Introduction to accounting

- Why have accounts?
 - Instruments on the dashboard of the company
 - To control, you must first measure
 - Statutory duty

Legal requirements;

- **Keep proper books of account**
- **Annual audit**
- **Solvency**

Principles of Accounting 1

- **Boundaries**
 - **Entity**
 - **Periodicity**
 - **Going concern**
 - **Quantative**

Principles 2

- **Measurement**
 - Money
 - Consistent cost basis
 - Realisation
 - Consistent time basis
 - Double entry
 - Materiality

Principles 3

- **Ethics**

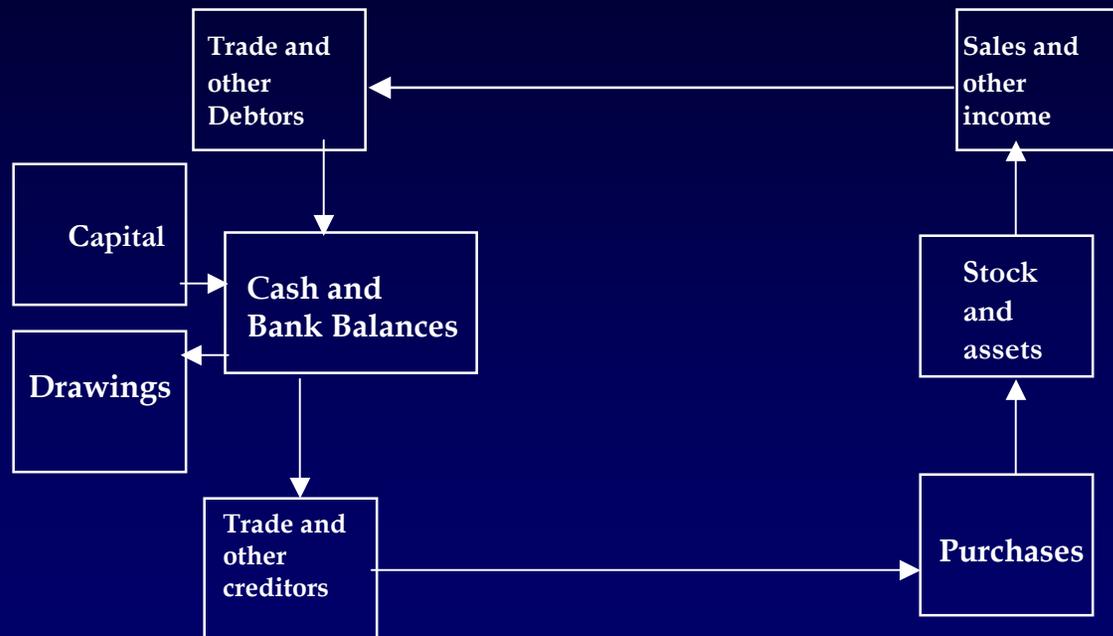
- **Prudence** - if in doubt, understate profits, overstate losses
- **Consistent** - use the same rules throughout
- **Objective** - avoid personal preference
- **Relevance** “True and fair”

Double entry

- **TERMS**
 - Debit: to receive. Income Owed to the company
 - Credit: to give. Outgoings. Owed by the company
- **Ledgers and balances**
- **Accountancy programs e.g. Pegasus**

Date	Description	Amount	Date	Description	Amount
	DEBIT SIDE			CREDIT SIDE	

Interlinking of Accounts



Measurement of Profit

- Profit and loss account
- Balance Sheet

Example P&L Budget

v

Example Profit and Loss Budget									
Month	1	2	3	4	5	6	7	12	Total
Income									
	30000		30000			30000		10000	100000
Expenditure									
Programmers	5000	5000	5000	5000	5000	5000			30000
Overheads	5000	5000	5000	5000	5000	5000			30000
Total costs	10000	10000	10000	10000	10000	10000	0	0	60000
Profit in the month	20000	-10000	20000	-10000	-10000	20000	0	10000	40000
Profit to date	20000	10000	30000	20000	10000	30000	30000	40000	40000

Cash flow

- Vital for small companies
- Working capital statement

Example Cashflow

Example Cash flow Budget										
Month	1	2	3	4	5	6	7	8	12	Total
Income			30000		30000			30000	10000	100000
Expenditure										
Programmers	5000	5000	5000	5000	5000	5000				30000
Overheads		5000	5000	5000	5000	5000	5000			30000
Total costs	5000	10000	10000	10000	10000	10000	5000	0	0	60000
Cash flow	-5000	-10000	20000	-10000	20000	-10000	-5000	30000	10000	40000
Cash in bank	-5000	-15000	5000	-5000	15000	5000	0	30000	40000	40000

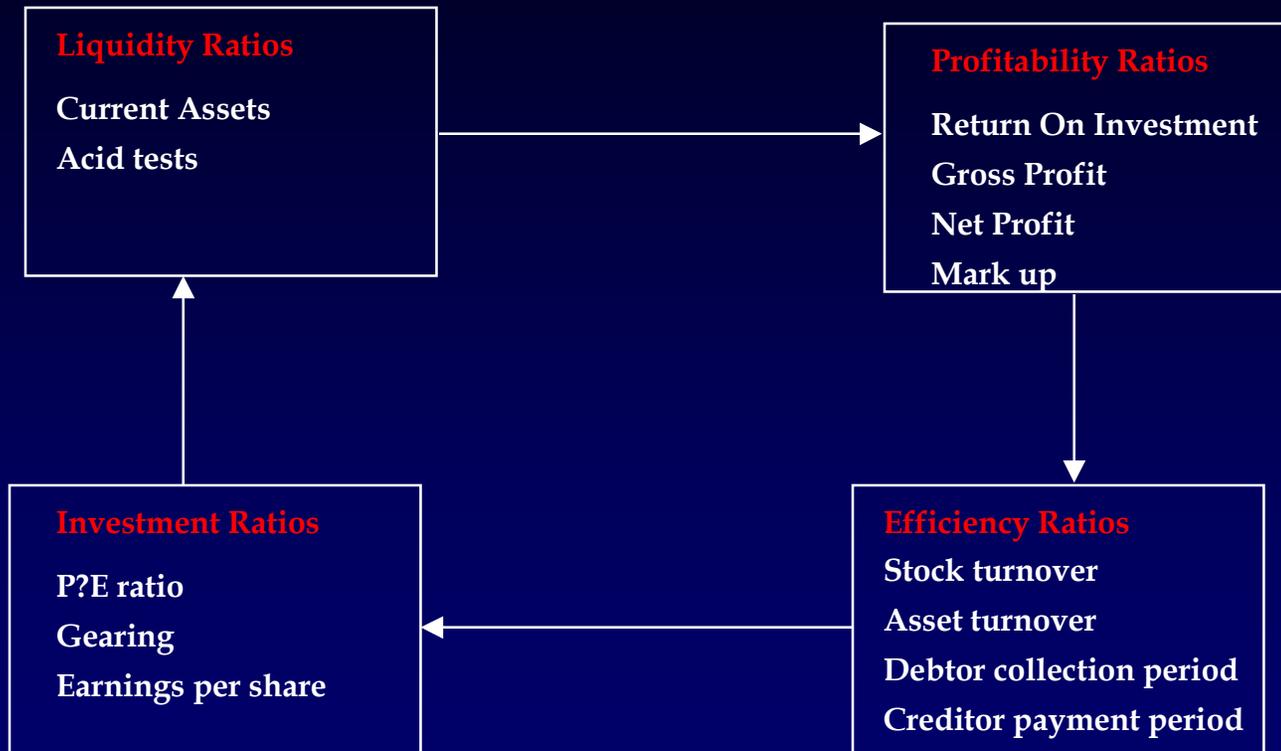
Revised Cashflow

Example Cashflow	Revised											
Month	1	2	3	4	5	6	7	8	9	10	16	Total
Income			30,000				30,000			30,000	10,000	100,000
Expenditure												
Programmers	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000				40,000
Overheads		5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000			40,000
Total costs	5,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	5,000	-	-	80,000
Cash flow	-5,000	-10,000	20,000	-10,000	-10,000	-10,000	20,000	-10,000	-5,000	30,000	10,000	20,000
Cash in bank	-5,000	-15,000	5,000	-5,000	-15,000	-25,000	-5,000	-15,000	-20,000	10,000	20,000	20,000

Example Balance Sheet

Example Balance Sheet as at beginning of Month 9				
FIXED ASSETS				
Computers			10,000	
Furniture			3,000	
CURRENT ASSETS				
Work-in-Progress		10,000		retainer, not yet invoiced
Trade Debtors		30,000		Amount invoiced, but not yet paid
Cash		0		Normally there would be some petty cash
LESS: CURRENT LIABILITIES				
Trade creditors		5,000		
Bank Overdraft		15,000		
NET CURRENT ASSETS			20,000	
REPRESENTING				
Proprietors Capital			13,000	The proprietor paid for the computer etc
Plus: Accumulated Profit			20,000	

Tests



Ratios

- **Current ratio**
 - **Current Assets / Current Liabilities**
 - Measures liquidity
 - < 1 indicates potential cash flow problems
- **Acid test (Quick Health check)**
 - **(Current Assets-Stocks) / Current liabilities**
 - Stocks may not be able to be sold quickly
 - Similar to Current Ratio, but shorter term
- **Gearing**
 - **Net Borrowings / Shareholders' Funds**
 - Reliance on borrowings
 - Vulnerability to interest rate rises
- **Return on Investment**
 - **Profit before Tax / Shareholders Funds**
 - Efficiency - 40% for sustainable high growth

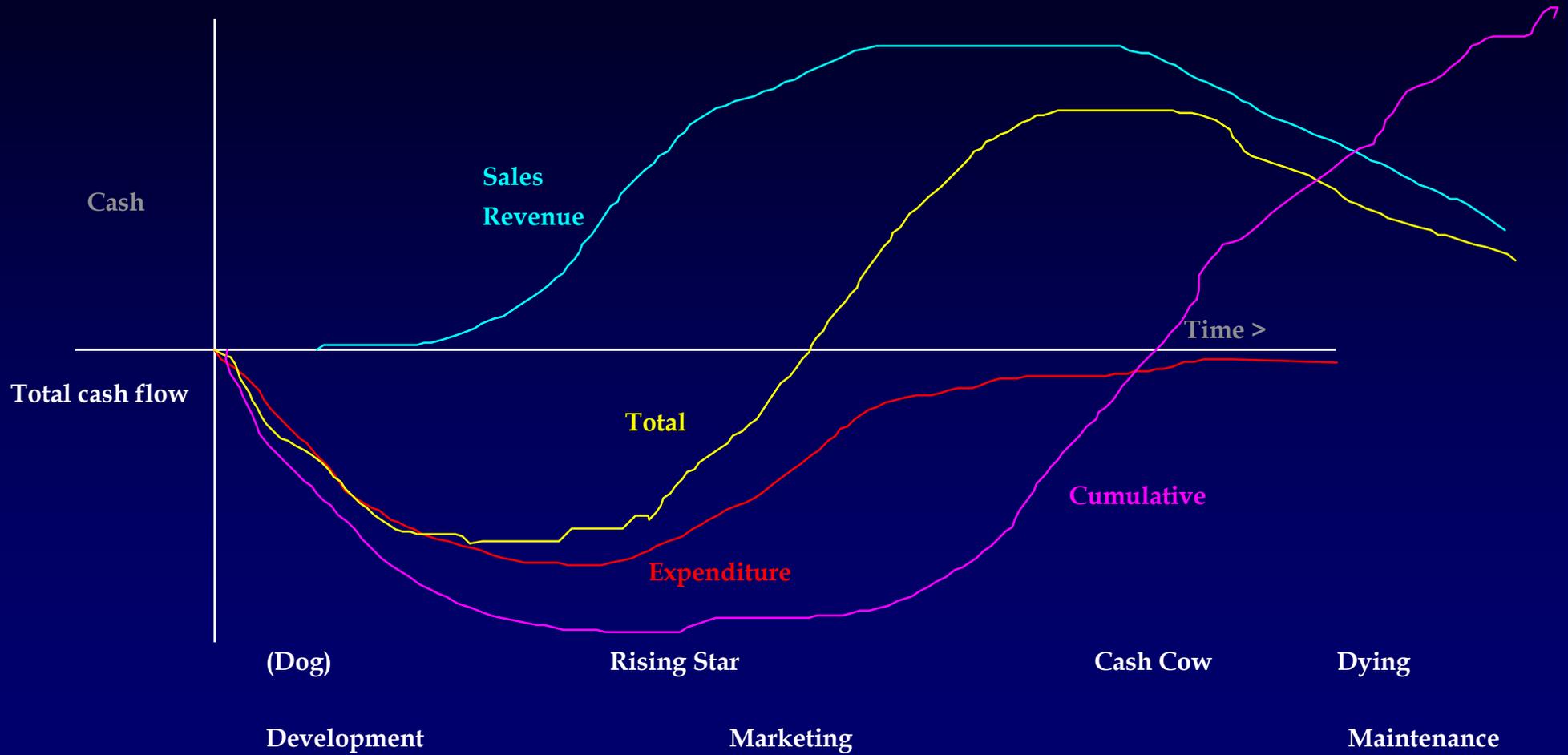
Budgeting

- Assumptions
 - “Pessimistic realism”
 - Tell the truth - know the worst
- Sensitivity analysis
- Comparison with actual
- Update!!

Spreadsheets, and other tools

INCOME										
(shown as actuals, not work in progress)										
Contract 1				10,000		20,000			20,000	30,000
TOTAL INCOME				10,000		20,000			20,000	30,000
EXPENDITURE										
Salaries, NI etc	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	18,000
Premises	3,000				3,000			3,000		6,000
Consumables		1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	5,000
Advertising etc		1,500	500	500	1,500	500	500	500	500	4,500
Capital equipment	18,000									18,000
TOTAL EXPENSES	24,000	5,500	4,500	7,500	5,500	4,500	7,500	4,500	4,500	51,500
Balance at start	18,000	-6,000	-11,500	-6,000	-13,500	1,000	-3,500	-11,000	-11,000	-1,000
Balance at end	-6,000	-11,500	-6,000	-13,500	1,000	-3,500	-11,000	-11,000	-11,000	4,500

Product stages



Debt and Equity

- Interest rates
- Loans
- Overdrafts
- Debenture and redeemable preferences

Sources of finance

- Banks
 - Security
- Family and friends
- Venture Capitalists
- Stock Market floatation

How much will I need?

- DO THE BUDGET
- Working assumption no income for 1st year
 - One man band, working from home £100,000
 - 5 people, office etc £1M
 - 20 people, small factory £5M

UK Company types

- Sole Trader
- Partnership
- Private company
- Limited Private Company (Ltd)
- Public limited company (plc)
- Listed company
- Special cases (e.g. Trusts, Societies)

Stocks and Shares

- **Shares**

- Ordinary and preference
- Voting and dividend rights
- Critical amounts (for normal Table A companies)
 - 25+% Blocks “Substantive” resolutions
 - 50+% Day-to-day control
 - 75+% Total control
 - Other trigger points for public companies
- Other rights and Coupons
- Directors accountable to shareholders

Buying and Selling Shares

- Illegal to advertise unless a member of an SRO (e.g Broker),
- Private company usually requires Board approval
 - Stamp Duty 0.5%
- Public company:
 - Primary market: Flootation
 - Shares traded on a public exchange
 - Listing: admitted to the Official List (UK: LSE)
 - Secondary market
 - Settlement
 - Illegal to use or divulge inside knowledge
 - Bull market: upward trend
 - Bear market: downward trend
- Capital Gains Tax

Options and Futures

- **Contracts to buy or sell at a fixed price at some future date**
 - Typically 10%
 - **Futures: Must complete as specified**
 - **Options: Completion optional**
 - Option and future contracts can be traded
- **Gambling - leave it to the professionals**
- **Markets are largely stochastic - no system**

How much is it worth?

- NPV
- Black – Scholes

The Model:

$$C = SN(d_1) - Ke^{-rt} N(d_2)$$

C = Theoretical Call Premium

S = Current stock price

t = time until option expiration

K = option striking price

r = risk-free interest rate

N = Cumulative standard normal distribution

e = exponential function (2.7183)

$$d_1 = \frac{\ln(S/K) + (r + \sigma^2/2)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

σ = standard deviation of stock returns

ln = natural logarithm

3. Setting up: Legal aspects

- **Setting up: Company Formation**
- **Brief introduction to business law; duties of Directors**
- **Shares, stock options, profit share schemes and the like**
- **IPR**
- **Company culture and Management Theory**

Company formation

- Legal entity:
- Purchase:
 - Solicitor
 - Agent: e.g. Jordans
 - Mem and Arts; Objectives; Share conditions
- Company books
 - Minute book: initial resolutions
 - Appointment of Bankers, Auditors

Details

- Premises: Serviced offices/ Lease/ Purchase
- Phone
- Net
- Letterhead (with company number)
- Accounts and accounting system
- Purchasing system; Contracts
- Asset control

More details:

- Insurance
- Recruitment
- Furniture
- Equipment

Plans

- Budget
- Project Plan
- Quality Plan
- Marketing plan

Brief introduction to duties of Directors

- Companies Acts
- Financial Services Act
- Shops Offices and Premises Act
- Discrimination Acts
- Data Protection Act
- Taxes: VAT, ACT...
- Etc, etc, etc....

Shares and share structure

- Shares govern the ownership of the company:
 - Distribution of control
 - Distribution of capital
 - Distribution of profits (dividend)

Control

- **Normal Limited company under Table A of Companies Act 1985**
 - **25%+ Block “Substantive” resolutions**
 - **50%+ Day to day control**
 - **75%+ Absolute control - but must respect the rights of minority shareholders**

Stock option schemes

- Agreement to sell shares at fixed price
 - Part of remuneration package
 - Recruit and motivate key staff
- Relevant for high growth companies
 - In a large company problem to make scheme relevant to work done
 - Profit share schemes
 - Exit route
- Balance advantages to company and staff
 - Nominal (par) price
 - 4 year monthly accrual; 1 year cliff
 - Lock in as employee
- Tax implications

Other remunerations

- Profit share
- Commissions (paid when?)
- Pension scheme
- Car

IPR

- **Intellectual Property Rights**
- **Patents**
- **Registered Designs**
- **Trademarks**
- **Copyright**

- **Internet Issues**

Patents

- **Absolute right to invention**
- **Bern Convention**
- **Expensive: need professional advise**
 - Seperate jurisdictions
- **Must be**
 - Novel
 - reducable to hardware
- **Provisional Patent:**
 - low cost,
 - one-year,
 - can be challenged

Trademarks

- **Right to exclusive use of name or mark**
 - classes of goods
 - Local jurisdiction
 - in USA use must be shown
- **Company name does not imply trademark**

Copyright

- **Copying prohibited**
 - but not re-invention
 - “clean-room” clones
 - Techniques: include nonsense signatures
- **Self-declarative**
 - Copyright <year> <Author>
 - library rights
 - Include statement of rights (e.g. backup)
- **FAST**

Internet Issues

- **Legality of Encryption**
 - Fight for your rights!
- **Signatures and contracts**
 - Jurisdiction
 - Audit trails
 - Liability
- **Domain names**
- **“Fair use” and copies**

Contracts

- **Complex law**
 - exchange of value
 - Fairness
- **Signatures**
 - Problem for Internet
 - TTP's, CA's
 - Trust and Liability
 - Signifying assent

Management

- **Goal setting**
 - Overall direction
 - Measures of success
 - Strategy rather than tactics
- **Culture lead**
- **Communication**

Management Theories

- “7 people is a natural hunting group”
 - Company growth break points: 7, ~50, 350...
- Classical/Hierarchical
- Human Relations

Classical

- **Formal and rational approach**
- **Focus on STRUCTURE of organisation**
- **Tasks reduced to simple elements -
>boring and repetitive**
- **Assumptions that individuals primarily
motivated by PAY**

Management Tasks - Classic model

- **Henri Fayon**
 - Objectives
 - Forecasts
 - Planning
 - Organising
 - Directing
 - Co-ordinating
 - Controlling
 - Communicating

Management Tasks - Classic model

- **F W Taylor**
 - All knowledge should be recorded
 - Scientific selection and progressive development of workforce
 - Work for maximum output
- **Frank and Lilian Gilbreth**
 - Time and Motion study
 - Introduced rest periods
- **Henry Gantt**
 - Gantt Chart
 - replaced piece rate with day rate and bonus

Human Relations

- **Consider individuals**
 - social needs
 - motivation
 - behavior
- **Focus on WORK done**

Theory X and Theory Y companies

- **Mc Gregor**
 - **Theory X: traditional heirarchical structure**
 - **Stick**
 - **Autocratic**
 - **Theory Y: People oriented**
 - **Carrot**
 - **Participative**

Theory X

- People don't want to work, they have to be made to do so
- People must be coerced, controlled, threatened
- Hierarchical structure, Defined roles, task oriented, little job flexibility
- Poor communication, status demarcations - "Them and us"
- Slow to change or adapt
- Traditional e.g. armed forces, smoke stack industry

Theory Y

- People want to work, but are prevented from doing so
- They will exercise self-control when committed to common objectives
- Accept and seek responsibility
- Flat management structure (e.g Matrix)
- Good communications, little status
- People oriented: Flexible work teams
- Adapts well to rapid change
- Most modern computer companies

4. People

- **Motivating factors**
- **Groups and Teams**
- **Ego**
- **Hiring and firing; Employment law**
- **Interviews**
- **Meeting techniques**

Management

- **Goal setting**
 - Overall direction
 - Measures of success
 - Strategy rather than tactics
- **Culture lead**
- **Communication**

Management Theories

- “7 people is a natural hunting group”
 - Company growth break points: 7, ~50, 350...
- Classical/Hierarchical
- Human Relations

Classical

- **Formal and rational approach**
- **Focus on STRUCTURE of organisation**
- **Tasks reduced to simple elements -
>boring and repetitive**
- **Assumptions that individuals primarily
motivated by PAY**

Management Tasks - Classic model

- **Henri Fayol**
 - Objectives
 - Forecasts
 - Planning
 - Organising
 - Directing
 - Co-ordinating
 - Controlling
 - Communicating

Management Tasks - Classic model

- **F W Taylor**
 - All knowledge should be recorded
 - Scientific selection and progressive development of workforce
 - Work for maximum output
- **Frank and Lilian Gilbreth**
 - Time and Motion study
 - Introduced rest periods
- **Henry Gantt**
 - Gantt Chart
 - replaced piece rate with day rate and bonus

Human Relations

- **Consider individuals**
 - social needs
 - motivation
 - behavior
- **Focus on WORK done**

Theory X and Theory Y companies

- **Mc Gregor**
 - **Theory X: traditional heirarchical structure**
 - **Stick**
 - **Autocratic**
 - **Theory Y: People oriented**
 - **Carrot**
 - **Participative**

Theory X

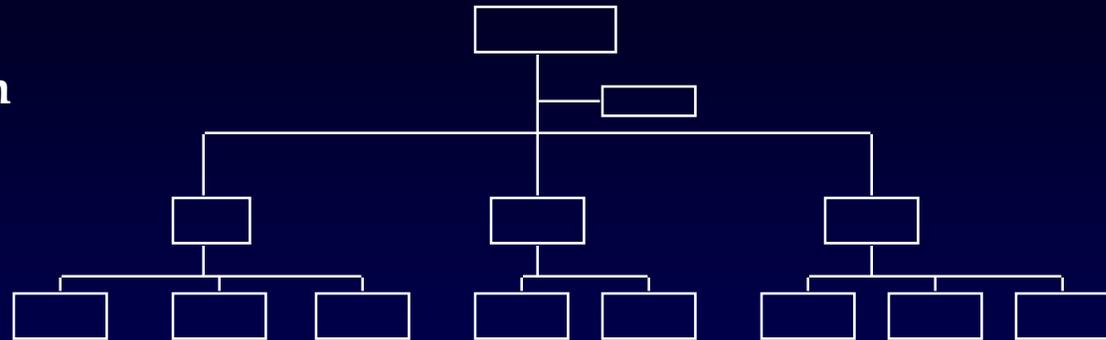
- People don't want to work, they have to be made to do so
- People must be coerced, controlled, threatened
- Hierarchical structure, Defined roles, task oriented, little job flexibility
- Poor communication, status demarcations - "Them and us"
- Slow to change or adapt
- Traditional e.g. armed forces, smoke stack industry

Theory Y

- People want to work, but are prevented from doing so
- They will exercise self-control when committed to common objectives
- Accept and seek responsibility
- Flat management structure (e.g Matrix)
- Good communications, little status
- People oriented: Flexible work teams
- Adapts well to rapid change
- Most modern computer companies

Management Structures

Hierarchical Organogram



Matrix example

Project ->	Home Group	1	2	3	4
People/Skill					
Alice	A	L (75%)		25%	
Bob	B		L (75%)		25%
Charlie	B	50%	50%		
Dave	A		25%		L (75%)
Elizabeth	A	25%			75%
Fred	B			L (75%)	

Theory Y

- People want to work, but are prevented from doing so
- They will exercise self-control when committed to common objectives
- Accept and seek responsibility
- Flat management structure (e.g.. Matrix)
- Good communications, little status
- People oriented: Flexible work teams
- Adapts well to rapid change
- Most modern computer companies

Human Relations

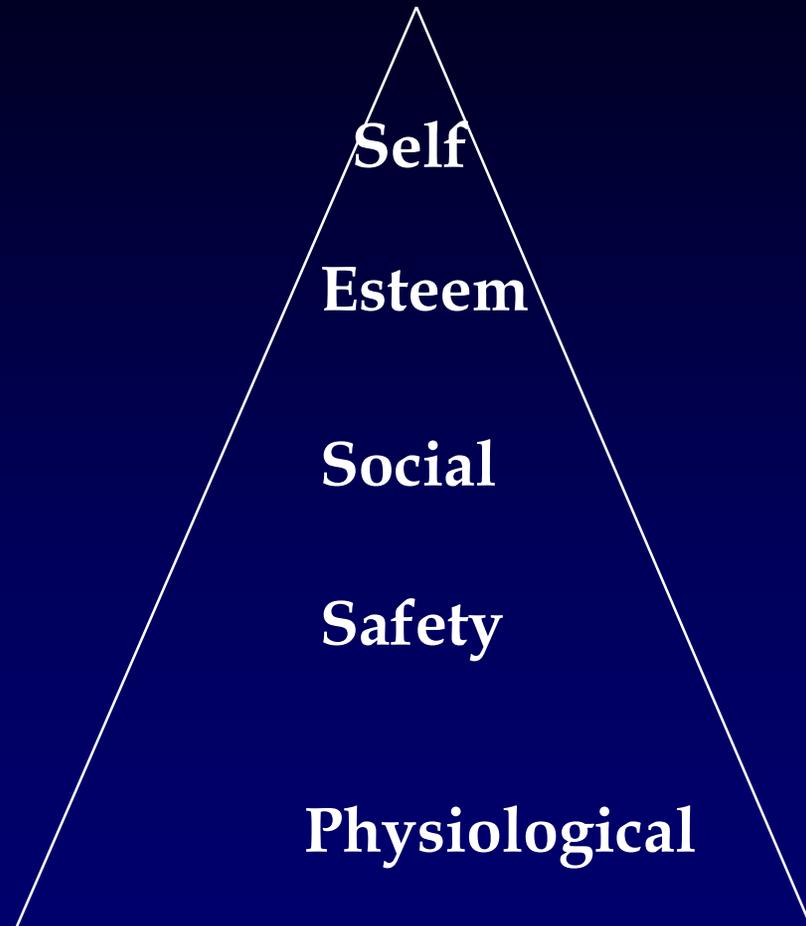
- **Consider individuals**
 - social needs
 - motivation
 - behaviour
- **Focus on WORK done**
- **People are the key asset**

Hierarchy of Needs

- Abraham Maslow
- Human needs arranged in levels
- As soon as lower level satisfied, the next level emerges and demands satisfaction
- Only unsatisfied needs motivate behaviour

Hierarchy of Needs

Growth
Realisation
Self Esteem
Recognition
Peer esteem
Belong, be accepted
Give and receive friendship
Protection from danger
Economic Security
Warmth
Food
Drink
Air



PAY is not a specific need, only a means

Groups and Teams

- **Limit to project size an individual can tackle**
- **“7 people is a natural hunting group”**
 - Company growth break points: 7, ~50, 350...
- **Informal as well as formal communications**

Groups

– (after John Adair)

- **Definable Membership**
 - a collection of two or more people identifiable by name or type
- **Group Consciousness**
 - Members think of themselves as a group
 - Collective perception and identification
- **Shared Purpose**
 - Common tasks, goals or interests
- **Interdependence**
 - Need to help each other to accomplish the purposes for which they joined the group
- **Interaction**
 - Communicate with each other
 - React to each other

Work Types

– (after Belbin)

- **Chairperson**
 - calm, controlled, self-confident
- **Ideas person**
 - individualistic, serious-minded, unorthodox
- **Shaper/Starter**
 - outgoing, dynamic, highly strung
- **Company worker**
 - predictable, dutiful, conservative
- **Resource Investigator**
 - extrovert, enthusiastic, curious, communicative
- **Monitor/Evaluator**
 - sober, unemotional, prudent
- **Team builder**
 - socially oriented, mild, sensitive
- **Completer/Finisher**
 - orderly, painstaking, conscientious, anxious

Stages in Group Development

- **Forming**
 - before individuals see themselves as a team
 - feels difficult, anxious, unsure
- **Storming**
 - challenge the leader
 - Hostility, aggression, emotions high
- **Norming**
 - organise tasks
 - co-operating, secure, comfortable
- **Performing**
 - work surges ahead, people perform well
 - openness, mutual trust and support, enthusiasm, inspiration

Ego-less programming

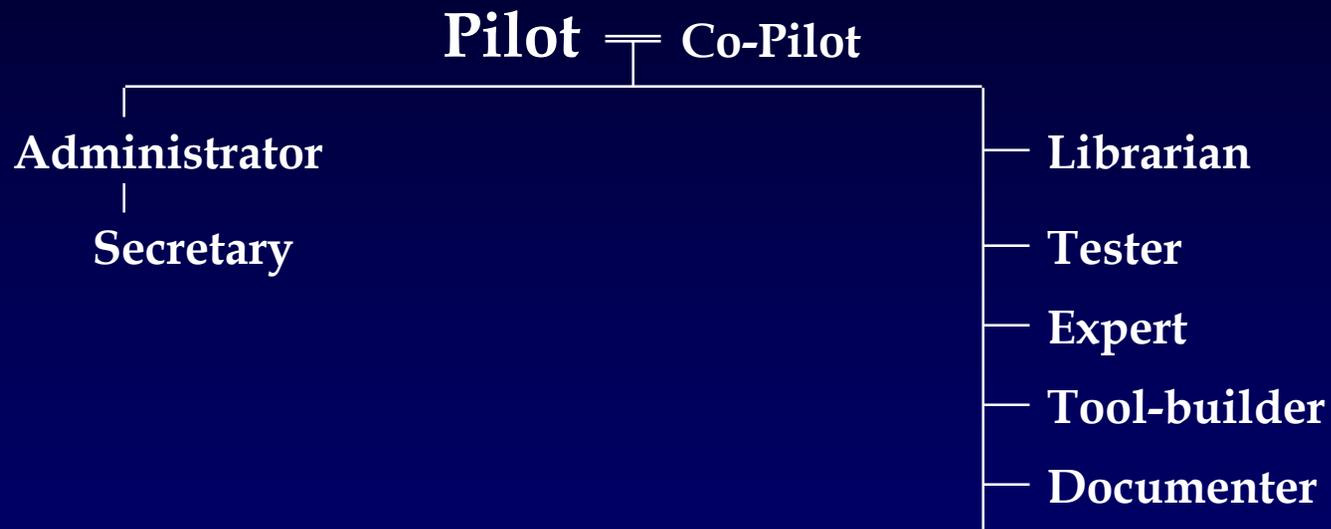
- Ego-less programming concept
- Culture
- It's OK to admit mistakes and ask for help

Networking

- **Teams do not exist in a vacuum**
 - Depend on help, co-operation with other teams to achieve objectives
- **Pitfalls if they don't network**
 - Inter-group hostility
 - Insularity and inward thinking
 - NIH factor

Chief Programmer Model

(after Brooks)



Hiring and firing

- **Employment contract/Statement**
 - Hours and holidays
 - Remuneration
 - Grievance procedure
- **Firing:**
 - 2 verbal, 2 written warnings - keep records
 - Redundancy

Non-discrimination

- **Sex**
 - harassment
- **Race**
 - Must show reason for non-nationals
 - work permit
- **Disability**
 - “Differently abled”

Recruitment

- Personal contact
- Advertisements
 - Net
- Agencies

Interviews

- Recruitment
- Appraisal

- **Why**

- Learn more about candidate
- Compare with job spec
- Give candidate further information about the organisation
- Encourage positive feeling about organisation

- **Preparation**

- Who needs to know, or be present?
- Who greets, refreshments, room, seating,
- Questions and outline
- Report form
- Circulate papers

Conducting Interview

- **Problems**

- Pre-conceived ideas
- Only remembering last candidate
- Eye conduct

- **Discussion**

- Create rapport - smile
- Summarise/reflect
- Listen - don't talk
 - Tone
 - Body language

Interview

- **Questions**
 - Speed/pace
 - Open/closed
 - Situational
 - Probing
 - Stress- why?
- **Close**
 - Check plan - covered everything?
 - Any questions?
 - Explain next stage
 - Check still interested

Interview -after

- **Make the decision**
 - skills
 - Personal qualities
 - Best compared to rest
 - CV's
 - Check references
 - Check unexplained gaps
 - Check unusually short job duration
- **Follow-up**
 - Offer
 - Contract
 - Induction

Appraisals

- **Purpose**

- Enable team members to get a clear idea of how they are doing
- Identify where they might need support/training
- Set objectives
- Personal career/growth

- **Form**

- Date, Name, Job title, Assessor
- Self assessment
- Assessor or line manager assessment
- Key objectives
- Development plan
- Actions - jointly agreed
- Follow-up

Interview

- 15 minutes to sell yourself
- Be yourself
- Enthusiasm, achievements
- Questions
 - What are the best and worst aspects the company?
 - Where will I be in 3 years time?

Communication skills

- Say it three times
- Not more than three major points
- What does the target audience know?

5. Project planning and management

- Role of a manager
- Charts and Critical Path Analysis
- Estimation Techniques
- Monitoring

Role of a manager

- **Directs resources for the achievement of goals**
- **LEADER also provides**
 - Vision
 - Inspiration
 - Rises above the usual
- **No one right way to manage**

Management Continuum

Authoritarian

Democratic

Autocratic

Consultative

Participate



Solves problems alone

Discusses Problems

Chairperson

Dictates decisions

Makes decision

Agrees problem

Creates consensus

Managerial Roles

– (after Henry Mintzberg)

- **Interpersonal**
 - Figurehead
 - Leader
 - Liaison
- **Informational Roles**
 - Monitor
 - Disseminator
 - Spokesperson
- **Decisional Roles**
 - Entrepreneur
 - Resource Allocator
 - Disturbance Allocator
 - Negotiator

Qualities

- **Technical/Professional knowledge**
- **Organisational know-how**
- **Ability to grasp situation**
- **Ability to make decisions**
- **Ability to manage change**
- **Creative**
- **Mental flexibility - Learns from experience**
- **Pro-active**
- **Moral courage**
- **Resilience**
- **Social skills**
- **Self Knowledge**

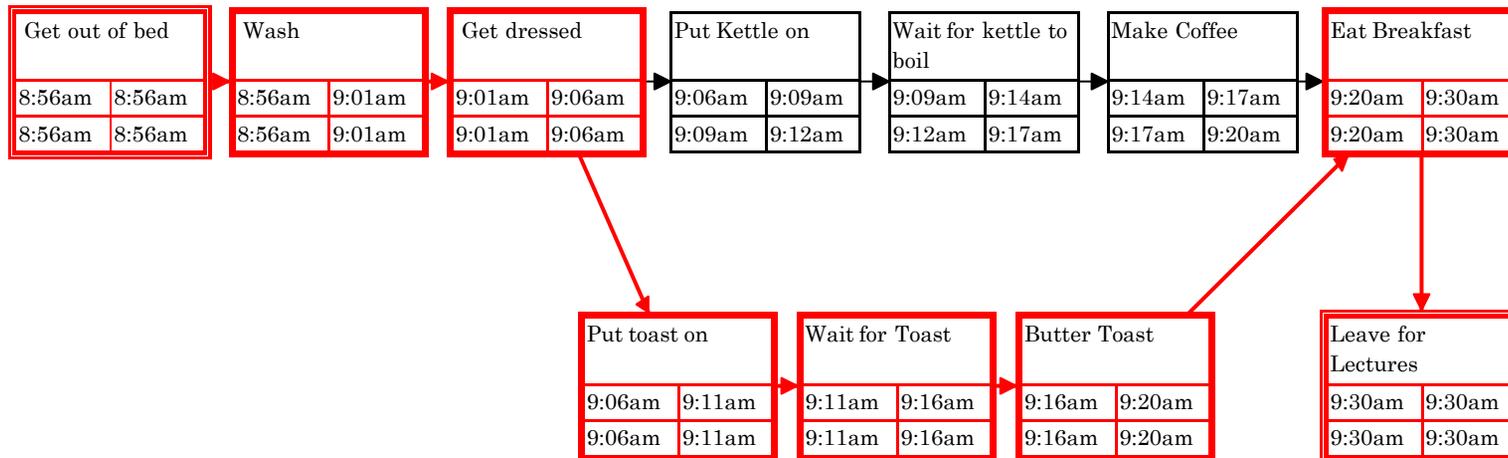
Pert and Gantt Charts

- Visual representation of project
- Microsoft Project

Example: Getting up in the morning

Task	Duration (mins)
1 Alarm rings	0
2. Wake Up	3
3. Get out of bed	5
4. Wash	5
5. Get dressed	5
6. Put kettle on	2
7 Wait for kettle to boil	5
8 Put toast on	2
9 Wait for Toast	3
10 Make coffee	3
11 Butter Toast	2
12 Eat Breakfast	10
13 Leave for Lectures	0

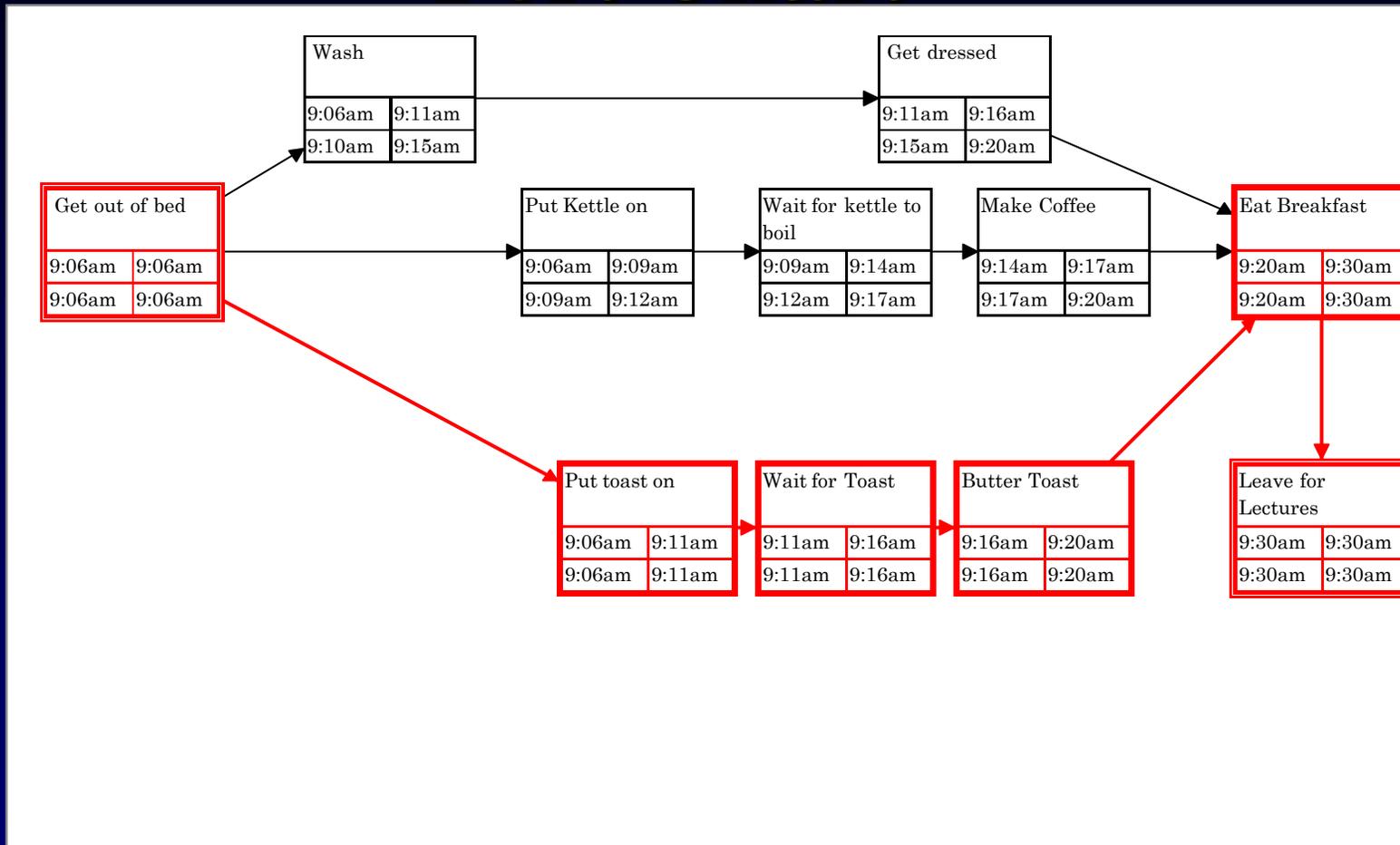
Pert Chart



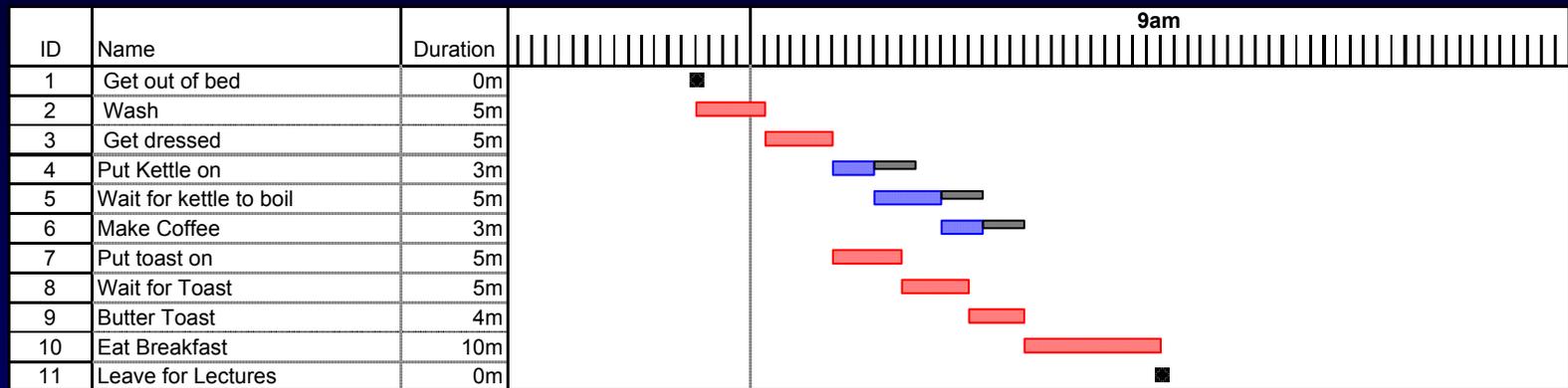
Critical Path Analysis

- Compute earliest and latest start/finish for each task
- The difference is the *slack*
- The Critical Path joins the tasks for which there is no slack
- Any delay in tasks on the on the critical path affects the whole project

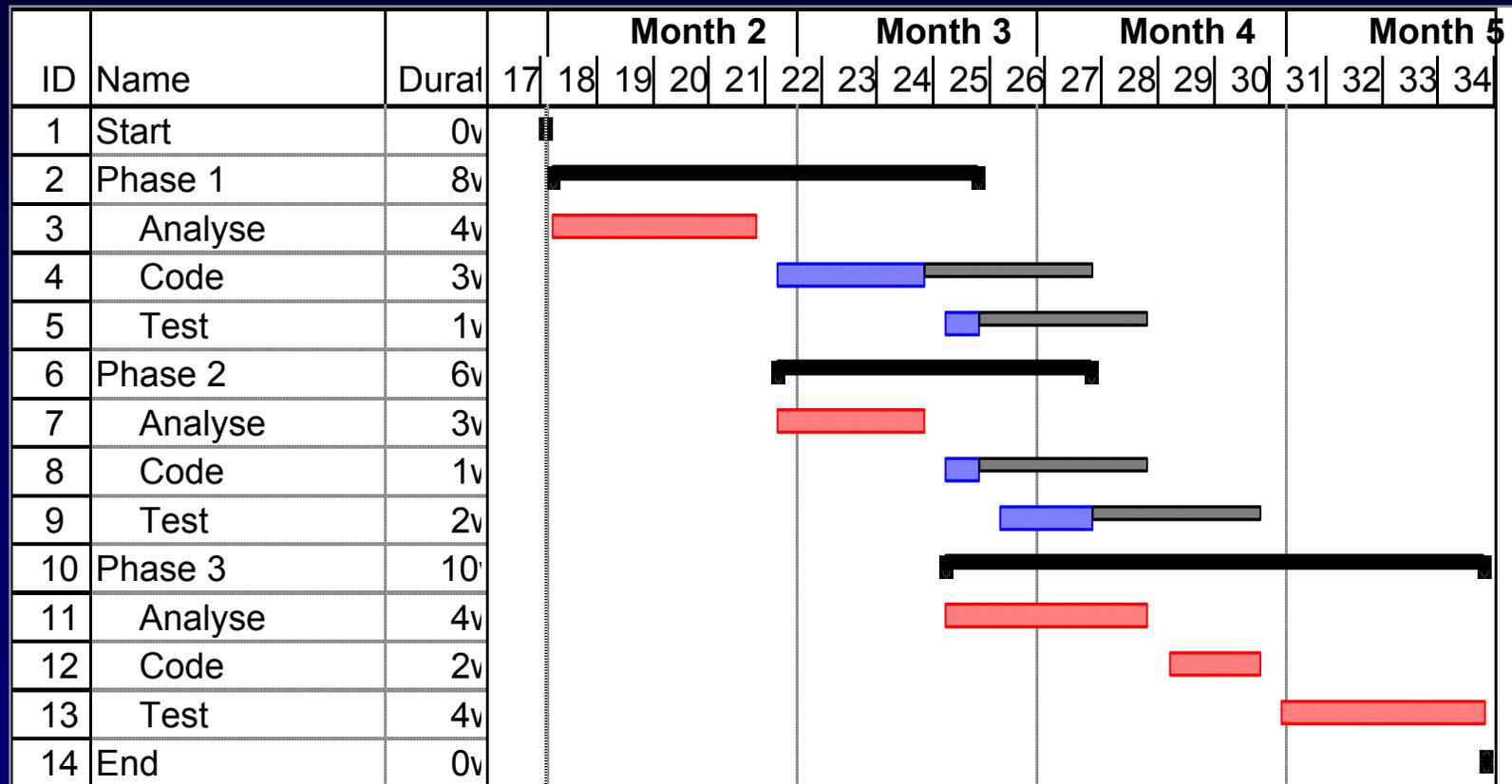
Pert Chart



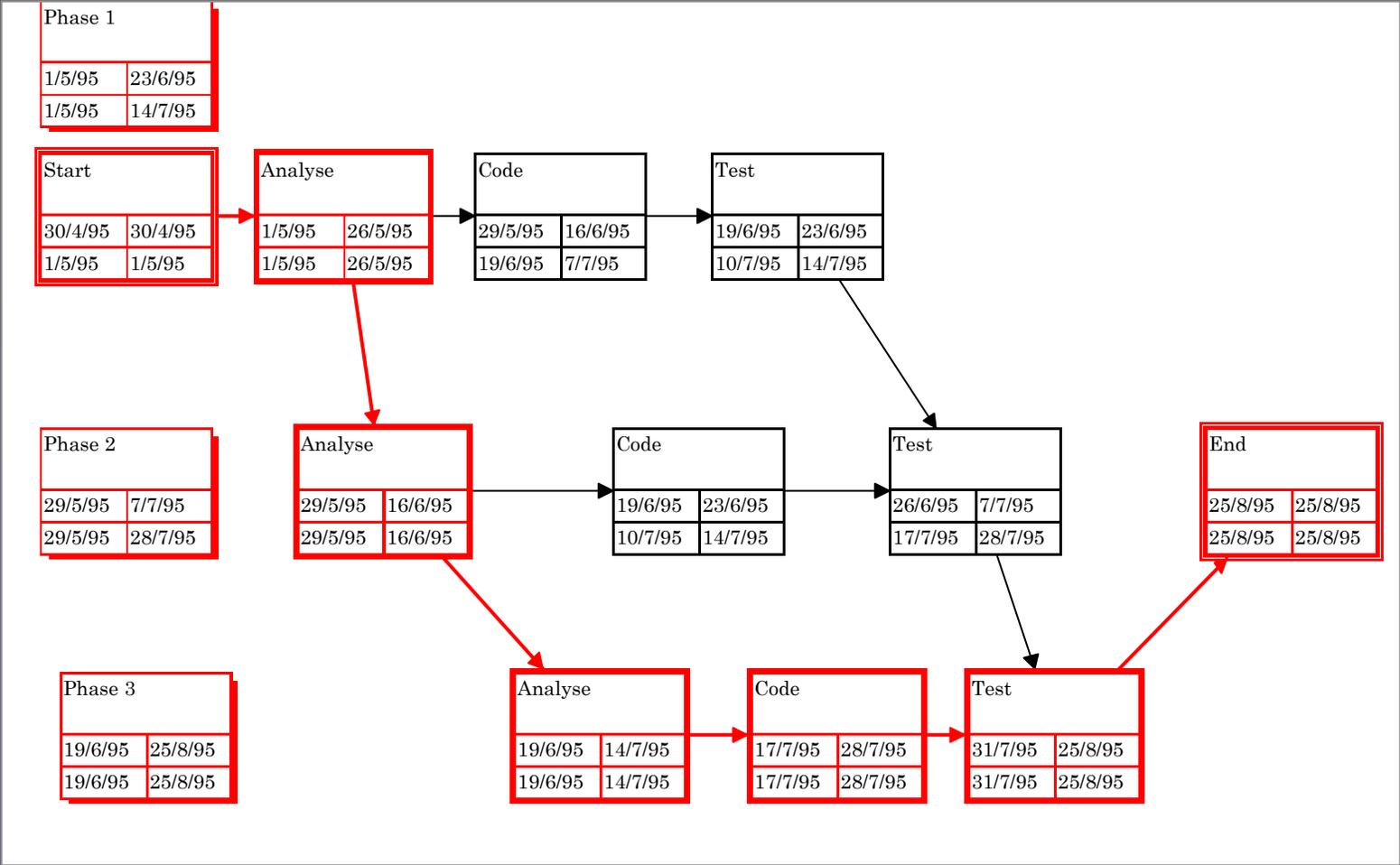
Gantt Chart

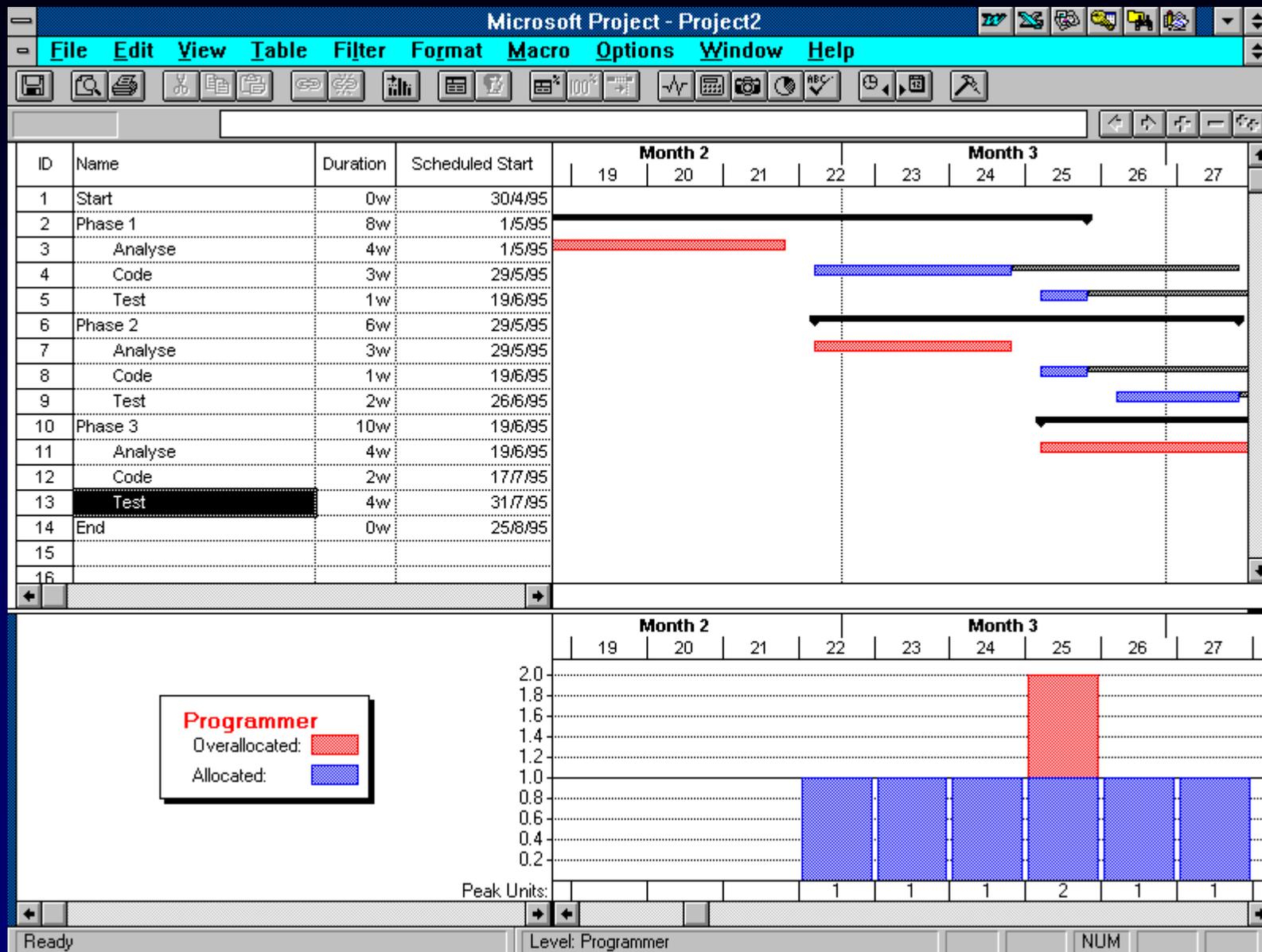


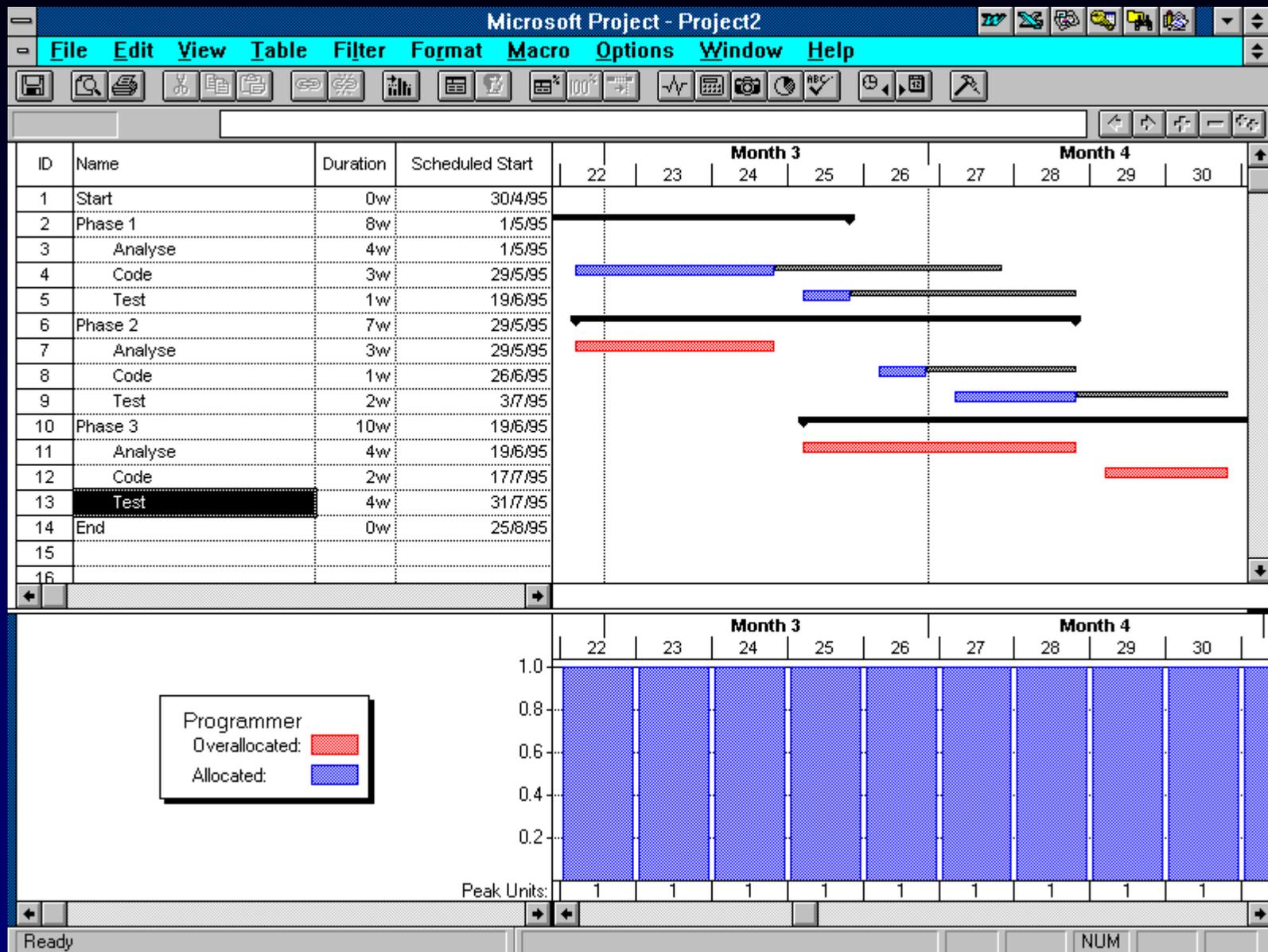
Example



Example Pert



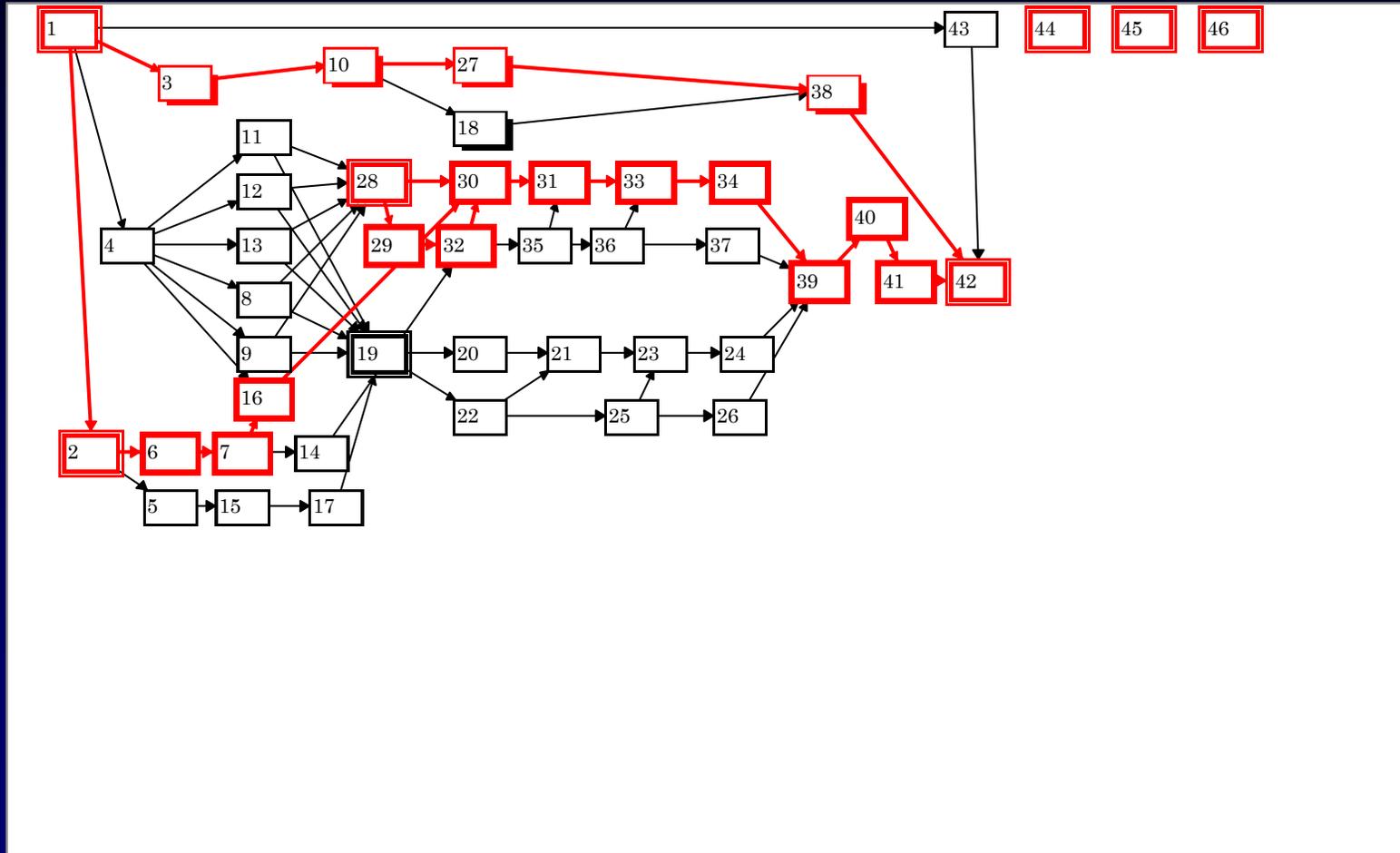




Levelling

- Adjust tasks to match resources available
- Automatic systems available, but do not always give an optimum result
- Tasks may be delayed within slack without affecting project dates
- Otherwise consider extending project, or using more resource
- Adding resource to late project may cause *RECURSIVE COLLAPSE*
 - consider carefully whether the benefits outweigh the additional learning delays and overheads
- Derive costings

Larger example



Estimation Techniques

- Experience
- Comparison with similar tasks
 - 20 lines of code/day
 - can vary by 2 orders of magnitude
- Decomposition
- Plan to throw one away
- 20 working days per month BUT 200 per year

Rules of Thumb

- **Software projects:**
 - estimate 10 x cost and 3 x time
- **1:3:10 rule**
 - 1: cost of prototype
 - 3: cost of turning prototype into a product
 - 10: cost of sales and marketing
 - >>Product costs are dominated by cost of sales
- **Hartree's Law**
 - The time to completion of any project, as estimated by the project leader, is a constant (Hartree's constant) *regardless of the state of the project*
 - A project is 90% complete 90% of the time
- **80% Rule**
 - Don't plan to use more than 80% of the available resources
 - Memory, disc, cycles, programming resource....

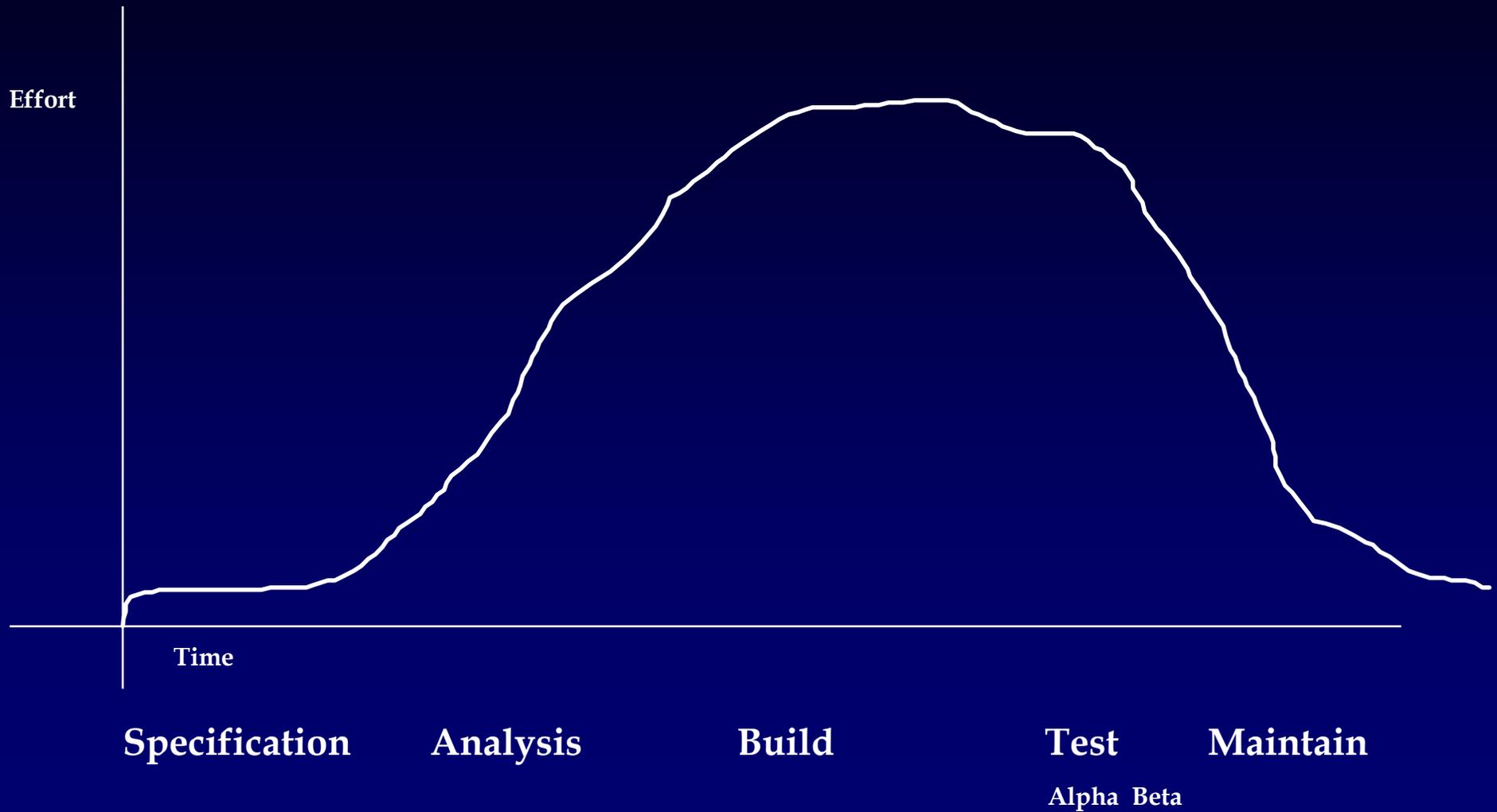
Cynic's Project Stages

- **Enthusiasm**
- **Disillusionment**
- **Panic**
- **Persecution of the innocent**
- **Praise of the bystander**

6. Quality, maintenance and documentation

- **Development cycle**
- **Productisation**
- **Plan for quality**
- **Plan for maintenance;**
- **Plan for documentation:**

Development cycle:



Approaches and methodologies

- **Top Down**
 - Waterfall decomposition
- **Bottom Up**
 - meta machine
- **Rapid Prototype**
 - successive refinement
- **Muddle through**

Productisation

- **Generalisation**
 - Does the product work on all target systems?
 - Hardware variants/constraints
 - O/S variants
 - Internationalisation
 - Language, number, date and time formats
- **Documentation**
 - Installation, User Guide, Reference Manual, Help texts, examples, training
 - System manual, maintenance documentation
 - Conformance
- **Legals**
 - IPR generated (Copyright, trademark)
 - IPR used
 - Licence, contract, liability

Productisation II

- **Packaging**
 - Artwork, Box, Deliverables
- **Manufacture**
 - Reproduction, Manual printing, Stocking
 - Distribution set-up
- **Marketing Materials**
 - Leaflets, brochures, advertisements
 - Text, Artwork, approvals
- **Testing**
 - Usability
 - Market
 - Standards approvals
- **Maintenance**
 - Organisation setup and training
 - Help desk - staff, facilities,, FAQs, training
 - Report forms, database and summaries

Plan for quality

- Cheaper in the long run
- Build-in from the start; can't be added later
- Board-level function
- “Good Practice”

Standards

- **ISO 9000/BS 5750**
 - Traceability
- **BS 7799**
 - Information Management and Security
- **Internal standards**

Control and review

- Record key decisions
- Control key documents
- Control versions and deliverables
- Define standards
 - Coding standards
 - Naming conventions
 - Routine structure
 - Testing
 - Documentation standards
 - House style
 - Conventions and examples
- Review and Audit

Key Documents

- **Project Definition**
 - User Requirement Document
 - Project Constraints Document
- **Base definition**
 - Functional Specification or prototype
 - Top Level design
- **Control**
 - Project Plan
 - Project Log
 - Quality Plan
 - Document Plan

Detailed Controlled Documents

- Sub-system specs and interfaces
- Data model and dictionary
- Module specs and interface
- Released code and documentation

Monitoring:

- **Early warning of impending disaster**
 - Time to do something about it
 - Avoid unpleasant surprises
- **Culture:**
 - **Communication**
 - Internal
 - With client
 - OK to ask for help
 - Requests taken seriously
- **Milestones**
 - Roughly one every 1-2 weeks
- **Review meetings**
 - Weekly

Meetings

- **Keep it short**
 - meetings are expensive
- **Circulate agenda and papers BEFORE**
- **Start on time**
- **Purpose and structure**
- **Finish on time**
- **1 page minutes**

Brain-storming

- Problem solving
- Purpose
- List ideas/topics, no matter how crazy
- Vote
- Work on top three
 - break up into subgroups
- Report

Agenda

- **Typical Board meeting**
- **Place for decisions, not discussion**
 - **CALL TO ORDER**
 - Attendance
 - Minutes
 - Matters arising
 - **STATUTORY BUSINESS**
 - **REPORTS**
 - Financial Report
 - Business Development
 - Personnel
 - Shareholder's Issues
 - **AOB**
 - **DATE OF NEXT MEETING**

SWOT

- Strengths
- Weaknesses
- Opportunities
- Threats

ACCTO

- **Criteria for customer acceptance**
 - Everett Rogers “The Diffusion of Innovation”
 - 80% of new product failures are due to new customer acceptance
- **A - relative Advantage**
 - competitive advantage over existing products
- **C - Complexity**
 - Can I understand it
- **C -Compatibility**
- **T -Trialability**
 - Can I test it without risk first?
- **O - Observability**
 - Can I see the benefits?

Testing

- Test plan
- Test suite
 - Base functionality
 - Specific bugs
 - Performance
 - Correct failure
 - re-run the entire suite each time
- Bug reports and database
- Action plan for fixes
 - Prioritisation

Plan for maintenance

- The relationship goes on
 - Revenue stream
 - 12% p.a
 - Future sales channel
- Levels
- Help desk
- Internal documentation
- Record keeping

Plan for documentation:

- 10 x the coding effort
- Specialist skill
- Levels of documents
 - User
 - Training
 - System
 - Maintenance
- Avoid forward references!
- Conformance

7. Marketing and Selling:

- **Sales and marketing are different**
- **Basic economics**
- **Marketing; Channels ; Market Communications**
- **Stages in Selling**
- **Control and Commissions**

Sales and marketing are different

- Marketing: What and how to sell
- Selling: moving the product
- Relationship management

Marketing

- **What?**
 - Product characteristics
 - Price sensitivity
- **Market Characteristics**
 - Size
 - Defensible
 - Sustainable
- **How?**
 - Channels
- **Inform**
 - Routes

Product or Service Requirements

- Know about it
- Opportunity to purchase
 - shelf space
- Satisfy a real or perceived need
- Affordable (but not too cheap)

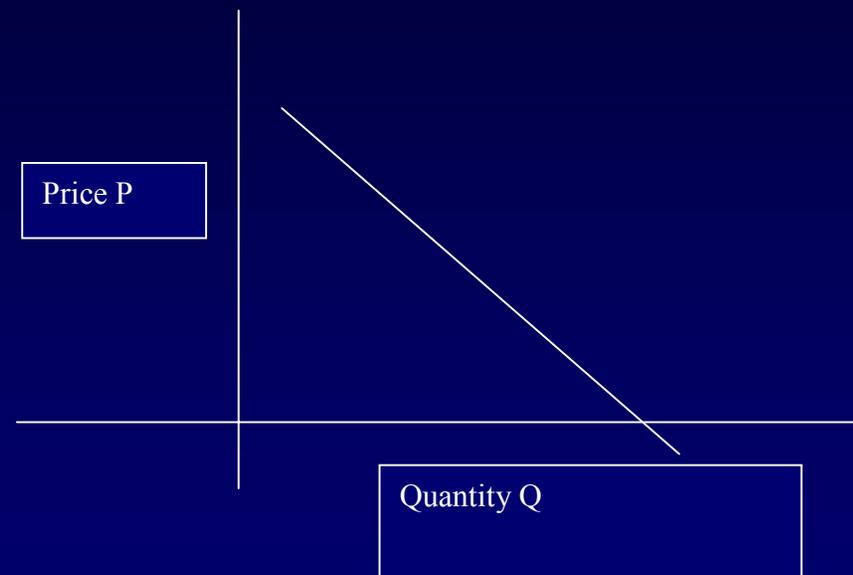
A brief introduction to market analysis

- **Desk research**
 - Existing market or solutions
 - Competition, actual and potential
 - Demographics
- **Market surveys**
 - Qualitative
 - groups, usability testing
 - Quantitative
 - Surveys, test marketing
- **Distribution channels**
- **Market Communications**

Basic Economics I

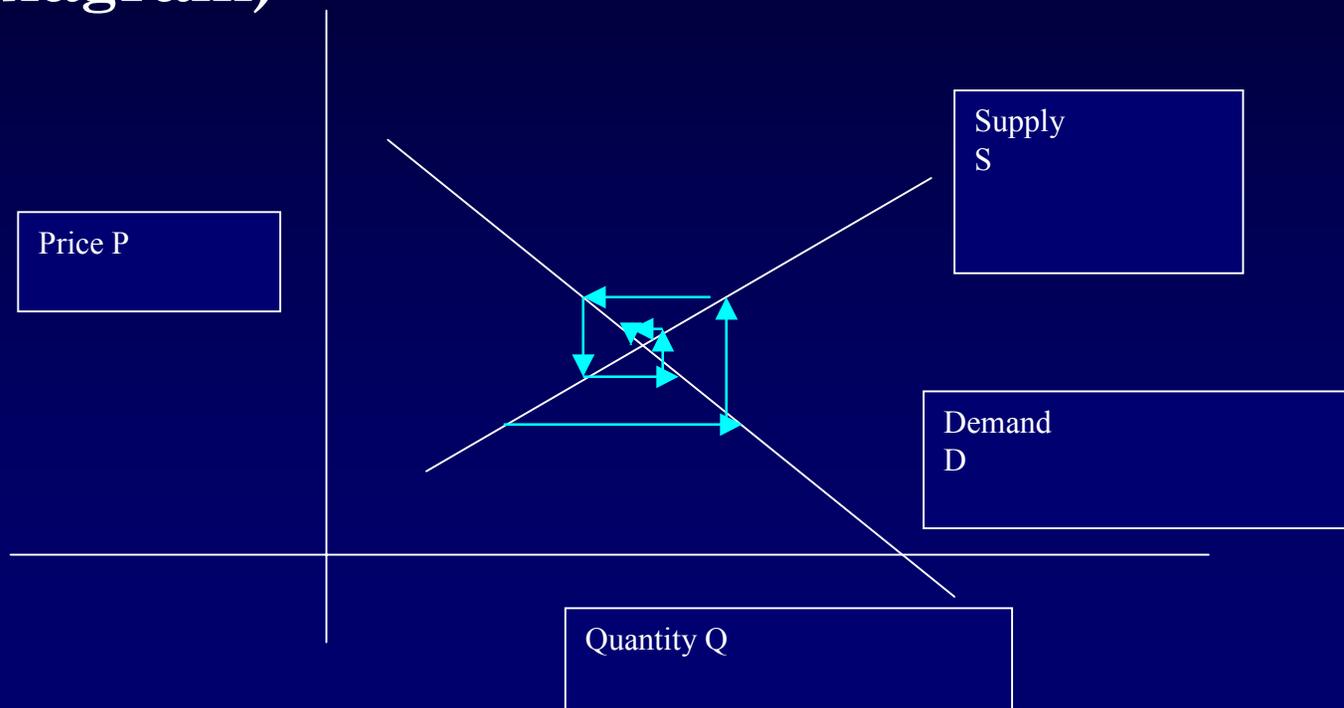
- Demand curve: Price depends on volume

$$\text{Elasticity } e = \frac{P}{\Delta P} \frac{\Delta Q}{Q}$$

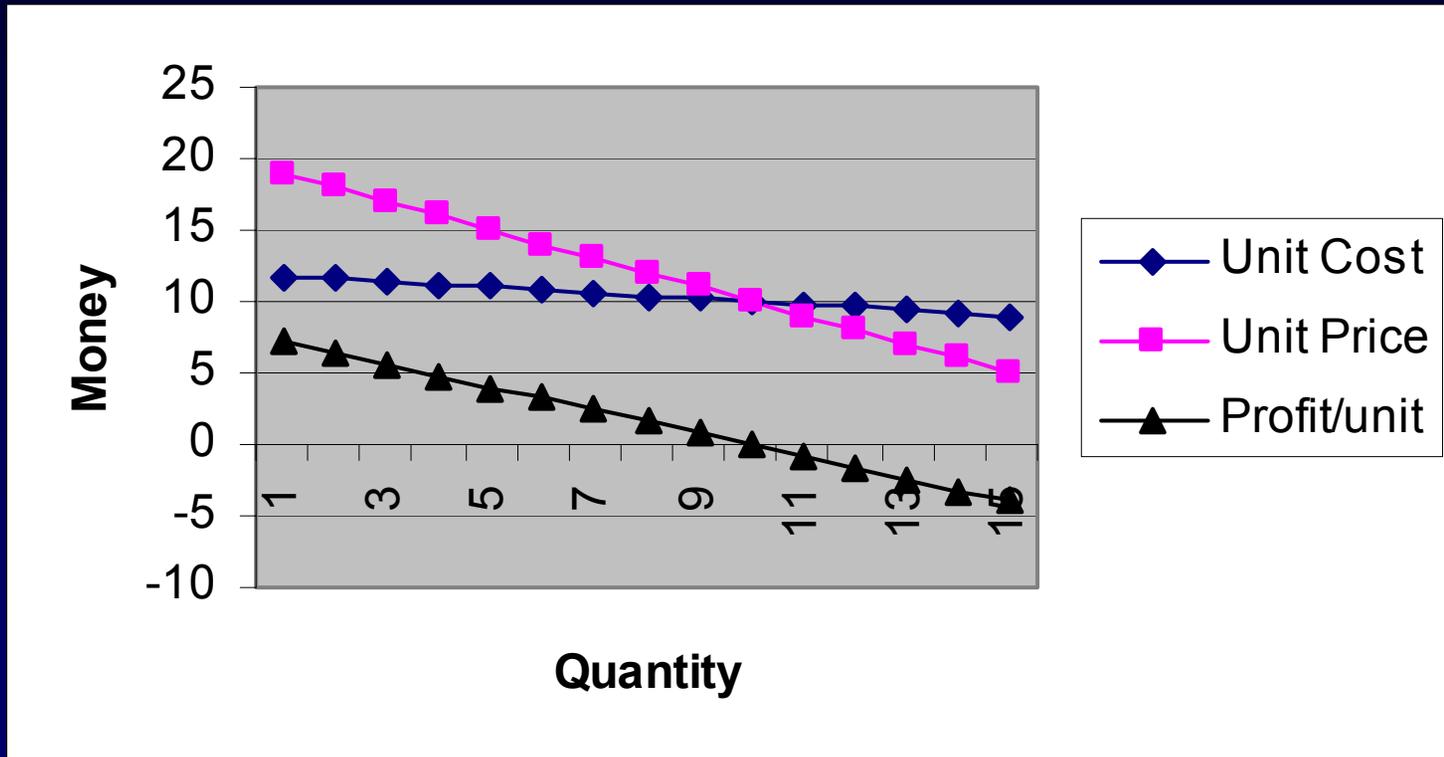


Supply Curve

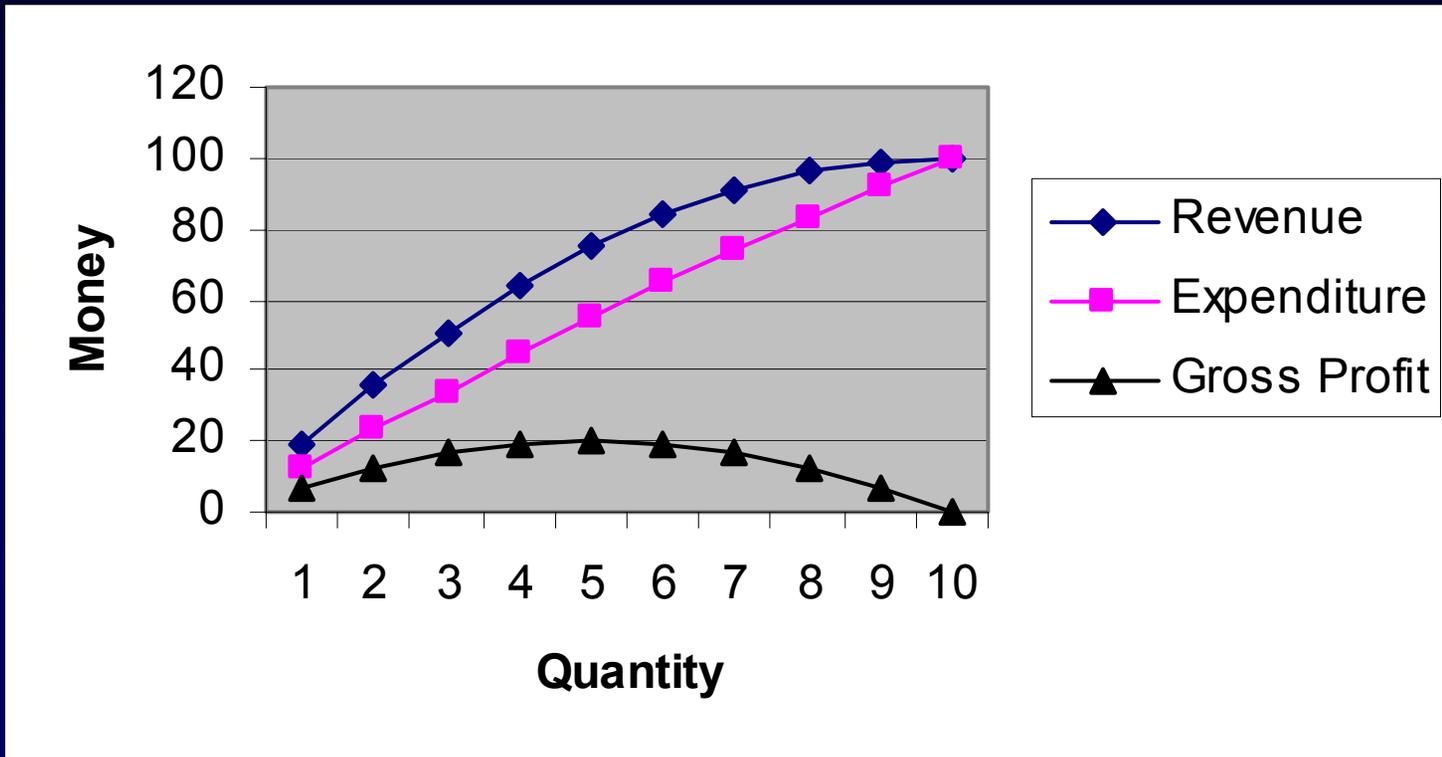
- Stable point is at intersection (Spider diagram)



Cost of Production



Gross Profit



Channels

- **Direct Sales**
- **Distributor/Retailer**
 - **Distributors are your customers**
 - **National**
 - **International**
- **Chose carefully -**
 - **changing is expensive and difficult**
 - **Key sales**
 - **Opinion formers**

Direct sales

- **Bespoke -**
 - sales staff/ Customer relationship manager
 - cash flow
- **Mail order requirements**
 - Product
 - Guarantees
 - Stocking
 - Support
 - Key accounts
 - Market communications

Distribution Channel

- **Typical product**
 - 40% manufacturer
 - development, materials, overheads, profit, research
 - 30% distributor
 - Advertising, stocking, profit
 - 30% retailer
 - Local adverts, shop front, staff, profit
- **International**
 - Localisation
 - Country agent
 - control/performance
 - Trade fairs
 - DTI outward bound missions
 - Embassy

Ballpark pricing

Sales price:		1000.00		
Factory price: (60%)		600.00		
Cost (30% of factory price)		200.00		
Net profit/unit (10% of factory price)		60.00		
Annual sales (Million):		1.00	(guess)	
Profit £M		60.00		
Set-up and fixed costs (£M) :		50.00	(including initial marketing)	
Stocking (6 months at cost)		100.00		
Capital need		150.00		
Payback time		2.50	years	

Market Communications

- Targeting
- Advertising
 - Image
 - Message
 - Sales - MOP
 - General - Newspapers, TV
 - Specific - Trade press, specialist magazines
- PR
- Direct mail
 - List brokers
 - 1-2% response
 - Control and record-keeping

Exhibitions

- **Expensive, hard work**
- **Make it obvious**
- **Place for meetings, not cold sales**
- **Preparation**
 - Stand
 - Exhibits
 - Manual
 - Travel and accommodation
- **Be attentive**
- **Follow-up**
 - Timeliness

Sales techniques: listen to the customer

- Needs
- Concerns
- Authority

Stages in Selling

- **Prospecting**
- **Pre-approach**
- **Approach**
- **Survey**
- **Proposal**
- **Demonstration**
- **Close**
- **Service**

Prospecting

- **Locating the most likely buyers**
 - Cold calling
 - Directors Guides, Yearbooks
 - Local council offices, Chambers of Commerce
 - Institutional meetings
 - Qualified Prospects
 - Marketing response: Advertising, PR, Mailings
 - Service organisation, exhibitions
- **How many?**
 - 10% result in a sale
 - Maybe 2 calls per day

Pre-approach

- **Research**
 - Who are the decision makers?
 - What is the management structure?
 - What are their concerns?
- **Preparation**
 - Presentation
 - Visiting cards, brochures

Approach

- Listen, establish mutual ground
- Contact building
- Generalities

Survey

- Needs, requirements
- Constraints
- Budget
- Structure, contacts, decision points
- Timescale

Proposal

- **Sell the benefits to the customer**
 - F.A.B
 - U.S.Ps
 - Price is not an issue; value is
 - Lifetime cost
 - Service, reliability, reputation
- **Sales proposal**
 - Introduction
 - Objectives
 - Recommendations
 - Benefits
 - Financial Justification
 - Warranty and service
 - Company Background
 - Price and conditions
- **Follow-up**

Demonstration

- Objectives
- Administration
 - Who, where, maps, car parking, accommodation
 - Greeting, seating
 - Catering: coffee, lunch or sandwiches
- Script
 - Rehearse, and stick to the script
 - Points to emphasise, or not
- Sum up
- Agree follow-up

Close

- **Small step at a time**
- **Advantages**
- **Customers concerns**
 - hidden agenda
- **Kicker**
 - Discount, limited offer

Service

- **Relationship management**
 - communications
 - contact point
 - Regular liaison
 - early warnings
- **Spec changes and the consequences**
- **Meeting milestones**

Planning and Records

- Graded Prospect List

Company				Contact				Previous Contact	Next Contact
Name	Address	Phone	Fax	Name	Decision Makers	Potential	%	Date Who Action	Date Who Action

- Sales Forecasts

Company	Amount	-----Time Analysis-----				Product Analysis	Comments
		Q1	Q2	Q3	Q4		

- Call analysis
- Sales Cost analysis

Control and Commissions

- **Control**
 - Sales organisation structure
 - By product
 - Geographical
 - By channel, key account
- **Measurement**
 - Cost per sale
 - Response rate
 - Timeliness
 - Individual measures, targets
- **Commission**
 - Don't stint
 - Basic salary
 - Pay on delivery, or payment

8. Growth and Exit routes

- **New markets: horizontal and vertical expansion**
- **Problems of growth; second system effects**
- **Management structures;**
- **Communication**
- **Exit routes: acquisition, floatation, MBO or liquidation.**
- **Summary**
- **Conclusion: now you do it!**

New markets

- **Horizontal**
 - Similar products or services
 - New Customers
 - Geographical/Export
 - New application area
 - New pricing
- **Vertical**
 - New products or services
 - Similar customers
 - New model
 - Vertical integration

Problems of growth

- **Communication**
- **Control and Monitoring**
- **Structural change; different skills, people**
- **Formalisation**
- **Cash**
- **Second system effects**

Communication

- Formal channels
- Charters
- Newsletters
- Company meetings and informal events
- Needs conscious effort: company culture

Management structures

- Groups and sub-groups
- Charters
- Reporting structures

Exit routes

- **Acquisition**
 - Weed patch model
- **Floatation**
- **MBO**
- **Liquidation**

Conclusion

- **Building the future**
 - Social Responsibility
- **Generation of Wealth**
- **Generation of employment**
- **Now you do it!**