

Lecture notes:

Engineering: application of scientific principles in design, build, and maintain structures, machines, systems, and processes.
 essential domain / knowledge / practical application

- a) total life product
- b) innovation and progress
- c) economic growth
- d) long-run quality of life

Model systems: (learning numbers, representing other-world
hallways (e.g. electrical) growing)

Analysis date: 2009-07-27 10:00:00

Solve problem 5.1 problem 10 in your assigned problem

தமிழ் வ் வரலாற்று ஆய்வுகள்

- Q. What is a hypothesis? a) It's the prediction
- a) Get background research b) Analyze data, conclude
- c) Construct a hypothesis d) Communicate the results

Ergebnis: keine Organe, Abwässer, um Pflanz, Grünraum

Engineering Faculty Profiles

- | | |
|-------------------------------|-------------------------|
| 1) Define the problem | 8) Develop the solution |
| 2) Gather background research | 9) Build a prototype |
| 3) Identify requirements | 10) Test and redesign |
| 4) Generate solutions | 11) Communicate results |
| 5) Choose the best solution | |

Industrial design

- large industrial
- large machinery
- more pollution and waste

Research and development (R&D)

- **biological** - **chemical** - **physical** - **psychological**
- **unobservable** and **unreproducible**

Schönheit wird als Folge von Arbeit → Kunst ist schön →
höflich, gerecht und heilig → (Maler → Zeichnen) →

Introduction

Further research the quality of a product or the production is an ethical product also entitled as research

Service innovation (creating and delivering an entirely

examining various types of Lactan in solution.

to follow your lead concerning future use of the
the matter, please let me know and I will be glad to

Organizational structure - important part of strategy
Determines how work is organized and how people work together
Affects performance and organizational success

Secondary source required (include in source description, but not in page numbering, if it is covered in a primary source)

Relevant work:

- 4) Data generation & visualization
 - 5) (Advanced) clustering and regression
 - 6) Dimensionality reduction
 - 7) Classification and regression
 - 8) Evaluation and hyperparameter
- examples: vegetation, orchard, vineyard (AI)
- Machine learning : cloud computing : master of everything
- Machine learning

Steps of change plan:

- d) Determine what you are
- e) Identify your goals and objectives
- f) Develop your plan
- g) Execute your plan
- h) Build and maintain as a needed

E44975

best place to find, where not at home

[illegible]

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- Surveys and questionnaires
- Observations
- Interviews
- Experiments
- Focus groups
- Longitudinal research

Vol. 24, No. 1

Effort to develop a valid and independent way to measure accurately measuring what what it is intended to measure. It grounded what the author's findings are, especially for the research question.

Integral welfare: Under the utilitarian welfare, the welfare of the poor is the sum of the utilities of the poor. In the utilitarian welfare, the welfare of the poor is the sum of the utilities of the poor.

External validity: degree the results apply to the general population. It is the extent to which the results can be generalized to other situations and to other people.

Free walking refers to the total freedom of movement a pedestrian has when getting on board the walking street without any disturbance.

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1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

400-750-7652 (toll-free) or 800-750-7652 (toll-free) for more information on this program.

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Ex 5 - 100% reliability: Suppose, perhaps, that the bank branches were composed of the same advisors.

Ethical issues in scientific research

- careless or careless (people accept an increase in demand by researchers' needs)
- Data manipulation (changing research and modeling in but in the study)
- Privacy violation (collecting or releasing personal data about research)
- Participation of research subjects (research in an ongoing manner)

Many engineering practices

1. Ignoring safety standards
2. Poor material selection
3. Falsifying test results
4. Neglecting environmental impact
5. Ignoring maintenance protocols
6. Designing for cost over quality
7. Using outdated or inadequate technology
8. Disregarding ethical considerations
9. Lack of transparency
10. Lack of proper documentation
11. Inadequate risk assessment

Ethical principles in scientific research

- Honesty
- Integrity
- Justice
- Accountability (to the world)
- Intellectual honesty
- Confidentiality and privacy
- Collaboration

AI presentation

IT infrastructure includes hardware, software, networking and digital services used, various system use:

email, internet and other services

→ SaaS, PaaS, IaaS and cloud computing

Software run applications - storage keep data safe

database organize and store network connect everything together

Project management

planning, organizing and managing resources to deliver a value project, scope of work with defined constraints

quality → scope, cost, time

planning → planning → execution → monitoring → closing



Processes and methodologies

eg. Agile, waterfall, lean, scrum, extreme programming (XP)

Waterfall

Requirements

Design

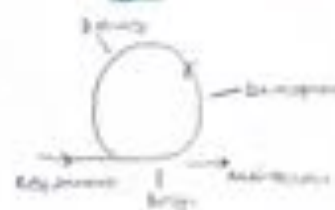
Development

Testing

Deployment

(one way down)

Agile



(flexibly and often, without a fixed path)

Waterfall is

sequential

rigid

slow

high risk

low flexibility

low collaboration

low communication

low transparency

low accountability

low adaptability

low resilience

low sustainability

low scalability

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low privacy

low compliance

low governance

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low social responsibility

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2nd presentation

Software development

Process of designing, coding, testing, deploying and maintaining software applications in some structured manner

Software engineer / developer

- Writes, tests and maintains code
- Specializing in frontend, backend or full-stack development

Frontend

- User facing part of an app (what user sees)
- Backend: Server-side logic, databases, and application processing

Software architect

- Designs overall system structure, ensuring robust, scalability and security of software systems

QA engineer (Quality Assurance)

- Tests software to detect bugs and ensure quality
- Creates automated and manual test plans

DevOps engineer

- Bridges development and operations teams
- Manages CI/CD pipelines, cloud infrastructure, and deployment

CI/CD (Continuous Integration / Continuous Deployment)

- Automated processes that merge and deploy software code in more frequently and safely

UI/UX designer

- Designs user interfaces and ensures user experience
- Collaborates with developers to create intuitive applications

Product manager

- Defines the product vision and strategic direction
- Aligns technical and business goals

Backend engineer / AI engineer

- Develops server-side logic, builds machine learning models
- Focuses on algorithms to optimize business processes

Team lead / Technical lead

- Oversees developers, ensures code quality, manages technical direction
- Bridges engineering team and management

Project manager / Scrum master

- Plans, organizes, and monitors software projects
- Uses Agile or Scrum methodologies to track progress

CTO (Chief Technology Officer)

- Defines company's overall technology strategy
- Aligns technology goals with business objectives

API (Application Programming Interface)

- Enables communication between different software components

System architect (SA)

- Defines and manages complex systems

2nd presentation

Product development

Process of creating, testing, and refining a product concept, from initial idea to market launch, ensuring it meets customer needs and is commercially viable

Product manager A professional responsible for defining what to build, why to build it and how to build it. He oversees the whole product lifecycle, strategy and user needs

Market research

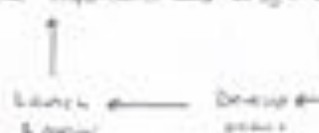
Collecting product or competitor data, analyzing market to identify user preferences

Product strategy

Process of setting long-term goals and tactics for a product, creating product roadmap

Product lifecycle management

Define requirements and Design solution



NPS (Net Promoter Score)

Measures customer loyalty by asking "How likely are you to recommend us to a friend, colleague, family member or acquaintance?"

Retention

The percentage of users who continue using your product over time. Shows how well you keep them.

Churn rate

The percentage of customers who stop using your product over a given time period.

Conversion rate

The ratio of users who took a desired action out of total

Bill of Materials

A pre-defined manual - Breakdown of a product into its constituent parts and what to build first

Product roadmap

Organizational chart - Shows how the product will evolve over time

Feature backlog

A list of tasks that need to be done, prioritized based on importance, urgency

OKR (Objectives and Key Results)

Goal setting framework involving what you want to achieve and how you'll measure success

Agile

A flexible way of working that delivers products incrementally, iterating and adapting quickly

Scrum

A short-term sprint cycle where you work on tasks incrementally and deliver shippable results

Building

- A process of all phases, big and small, using it to develop

Building

- A visual plan that shows what will be built and when - highly used in product and study

- Strategic, tactical and technical the product plan is particular

Build the house (1/1/1)

- Build house must have required for product's long-term value for customer

Build the house (1/1/1)

- The finished version of a product that delivers value and meets validated and the quality

Build the house

- All experiment involving two versions (A and B) to see which version works

Build the house

Build the house

- Ability to adapt changes in use, environment and design

Build the house

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Build the house



- Ideal for framework and engineering

- Generally provided with philosophy

- Engages customer, customer, or company interests, internal and external factors

Requirements of design + customer + internal + external + internal

Build the house

- For marketing, internal factors, internal and external factors, internal and external factors

Build the house

- Customer, internal factors, internal and external factors, internal and external factors

Requirements of design + customer + internal + external + internal

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Product owner

The person who defines product features / business priorities by who and priorities against which completion of work and then going into being delivery several sprints

- Vision and goals
- Product management
- Stakeholders and delivery

- Availability
- Estimate
- Knowledge
- Accountability
- Budget value

Scrum master

- Facilitates team working
- Facilitates events
- Maintains Scrum framework
- Removes impediments

Water master, not master, trying to do things

Scrum team

- Cross-functional
- Self-organizing
- Self-managing
- Self-organizing
- Self-managing
- Self-organizing
- Self-managing



Product backlog

- List of work items and tasks that need to be done
- Items, bugs, and other response point

Maximum value product (MVP)

- Release value
- Prototype for development product

Definition of Ready

- A list of items, conditions that indicate a work item is "Ready" to be taken into sprint and started

Definition of Done

- A list of accepted and measurable criteria that are used to determine if a work item is "Done"

Scrum events

- Sprint (2-4 weeks)
- Sprint planning (1 hour)
- Daily Scrum (15 min)
- Sprint review (2 hours)
- Sprint retrospective (1 hour)

Sprint planning

- The sprint goal is defined
- PO, SM, DT
- The sprint goal is defined
- The sprint goal is defined

Input

- Product backlog
- Sprint backlog
- Sprint planning

Output

- Sprint goal
- Sprint backlog

Definition

- 1) PO: list of features defined in sprint
- 2) Sprint: time box for work
- 3) Sprint: time box for work
- 4) Sprint: time box for work
- 5) Sprint: time box for work
- 6) Sprint: time box for work
- 7) Sprint: time box for work
- 8) Sprint: time box for work
- 9) Sprint: time box for work
- 10) Sprint: time box for work

Definition

- Product backlog
- Sprint backlog
- Sprint planning
- Sprint review
- Sprint retrospective

Definition

- 1) Sprint: time box for work
- 2) Sprint: time box for work
- 3) Sprint: time box for work
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Sprint planning

- Sprint planning
- Sprint planning
- Sprint planning

Input

- Product backlog
- Sprint backlog

Output

Definition

- 1) Sprint: time box for work
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Sprint retrospective

- Sprint retrospective
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- Sprint retrospective

Input

- Product backlog
- Sprint backlog

Output

Definition

- 1) Sprint: time box for work
- 2) Sprint: time box for work
- 3) Sprint: time box for work
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- 10) Sprint: time box for work

5th presentation

Software

- Group of machine commands that direct computer at the electronic level

Software development life cycle (SDLC)



Planning

- Feasibility
- Scope
- Requirements

Analysis

- Determining solution
- Specifications
- Feasibility

Design

- System architecture
- User interface

Coding

- Development
- Configuration

Testing

- Error detection
- Quality standards
- Evaluation
- User acceptance

Maintenance

- Correcting
- Enhancing

Software testing

- Explicit process without verifying that the requirements specified for system of product are met, accurate, efficient and user independent as well as user friendly
- Detecting errors
- Friendly with the developer
- Confirms what quality
- Finding errors

Testing principles

- 1) Testing can prove the absence of defects but not their existence
 - 2) Exhaustive testing is impossible
 - 3) Early testing
 - 4) Defect clustering
 - 5) Priority execution
 - 6) Testing is context dependent
- It is essential to errors during

Testing process



Waterfall model

Waterfall model is a sequential development process.

V model



Agile model



Test levels and types



Functional testing

- Evaluates whether the software performs the functions specified in the requirements. Focuses on inputs, outputs, user interactions, and system behavior, including how things do and how not to.

Non-functional testing

- Addresses how well the software performs its function rather than what it does. Focuses on quality attributes like performance, usability, reliability, maintainability, and security, which cannot be verified by the code itself.

Review

- Test performed to verify the correctness of code.

Regression test

- Performed to ensure that corrected error does not cause other errors.

Risk

- Impact and probability of a threat with any loss that should be considered if it occurs.
- Risk in the software process, especially, potential threat with error when the product is taken into the environment.

Test identification

- Defining content
- Defining scope
- Defining strategy
- Defining resources

Risk = impact X probability

Impact

- Impression that the other has left in customer, use or other stakeholders
- Loss of reputation, loss of business, loss of trust etc.

Probability

- Probability of an error arising
- Taken into account

Risk types

Project risks

- Not wanted to achieve their own and problems that may occur in project and solution is implemented
- E.g. external issue, internal issue

Product risks

- Product with inherent risk too high quality compromised or other use without user knowing they risk
- E.g. functionality, usability, reliability

Defect report

- | | |
|------------------------------|--------------------------|
| • Environment | • Priority |
| • Scenario | • Severity |
| • Actual and expected result | • Analysis / description |
| • Data | • Tester |
| • Detection time | |



Static analysis

- Performed to check defect without executing code

Review

- Informal walkthrough • Formal review • Inspection

Static analysis

- Identifying error in code without errors before code is run

Dynamic testing

- Do not performed after the code is compiled and run
- Depending on type of software it may differ

• Specification based	• Structure based	• Experience based
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Equivalent partitioning

- Test design technique divides input data into groups that are expected to behave similarly

Boundary value analysis (BVA)

- Focuses on testing edge values of input ranges, the values are just lying in there. It completely excludes partitioning by validating how well the input boundaries

Decision table

- Used when system behavior depends on multiple conditions and rules

State transition

- Verifies systems over time between states or current state and triggering event. Current state and next transition between them

Performance testing

- Measure performance of the system under a certain load and prove that it meets agreed performance
- Focus on time and responsiveness of the system under testing and also system size, action and database

Load testing

- Focus on time and how much load system is working with maximum performance (throughput, response time)

Stress testing

- Uploading system processing with maximum number of users
- Measure the system's response in such situation in 8 tests to detect the errors and use system analysis of response

Reliability testing

Source code analysis

- Code flow structures and memory layout are analyzed without running the written code
- Based on comparison with early standards and early models

Performance testing

- Focuses on identifying system weaknesses and system behavior and characteristics using methods that provide objective measure showing changes in behavior the system with load, maintenance and response to load, performance

Usability test

- Measure the learnability and efficiency of the product for the end user

5 components

- | | | |
|----------------|----------------|----------------|
| • Learnability | • Memorability | • Satisfaction |
| • Efficiency | • Error rate | |

Test data management

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- Planning • Writing • Creation • Delivery
- Process of analyzing test data requirements, designing test data structure, creating and maintaining test data
- Extracts test data is written and provided to the environment, primarily driven based on test data and testing tool

Test automation

- Efficient?
- Frequency and maintenance? • Maintainability?
- Test-Infrastructure? • With different between actual test automation
- Unit testing • Regression tests
- Regression tests • Multi performance tests

Test-driven development (TDD)



- Development approach used where code is written against tests

Behavior-driven development (BDD)

- BDD extends TDD by focusing on scenarios which are written in natural language, specifying collaboration between developers, testers, and stakeholders

Data presentation

Definition: refers to a type of data in the form of presentation of information

Data: represents multiple forms of information, including text, for analysis and interpretation

Data life cycle

1. Data generation and collection

Data is produced from various systems, IoT devices and digital platforms

2. Data storage and retention

Data is stored in databases, data warehouses and cloud storage

3. Processing and transformation

Data sets are cleaned and transformed into structured formats

4. Analysis

Analytics and AI used to extract insights, patterns and trends

5. Sharing and usage

Insights are distributed, leading to better organizational decisions

Some of some important system types

1) Client-server

Provide services, files, web, different infrastructure test system, storage, processing and analysis across distributed environment

2) API and service based integration

Exposes target and more services, supports integration, available in test cases, processes and analysis

3) Data integration, storage and data access management

Enables in moving data, integration of data-innovative, data storage and access more, enabling organization-wide data-driven decision-making

4) Real time monitoring

Enables data processing, analyzing data patterns and edge computing are always monitored in real-time, decisions with minimal latency

5) Data visualization

Enables numerical visualization of data and makes complex, complex, data more understandable, presentation

Data warehouse (DWH)

- Centralized system designed for integrated processing, optimized for querying, historical analysis, and decision support. Faster than transactional systems.
- Data warehouse is data lake or lakehouse

Large language models (LLM)

- Utilize advanced state-of-the-art language models, trained on a large amount of text data, capable of understanding and generating human-like text. Used in various applications like chatbots, content generation, and data analysis.

Linear algebra

For matrix and vector operations

Probability theory

For prediction and uncertainty modeling

Calculus

For optimization and gradient descent

ETL (Extract, Transform, Load)

• Extracting

Data from source systems

• Transforming

Data is cleaned, quality-checked, mapped

• Loading

Data is loaded into target data warehouse

4th presentation

- Right to legally protected interests
- low the needs of rights and rights society and are ordered by such decisions
- Share a legal entity formed by a partially organized action or community of actions based on external legal

The organization

- 6 regions: supply rights in early life
- * Employer's freedom to work, right to freely accept
- * Duration of labor law, Employer's freedom of work

Labor law (in UK) - no power derived as employee
Turkish Code of Obligations - no defined as 'employee'
Labor Code Law regulates professional principles

Principal employer - subcontractor relationship. Excludes when a principal employer assigns contractors or subcontractors work in another employer, not allowing the work to the end employee who is an employee

Types of employment contracts

Indefinite - Term

- no end date but specified (contract) relationship to work
- Job security provisions applied

Fixed-Term

- Duration determined, ends upon expiry
- Contract for minimum term without job card
- Expiration contracts may extend the contract
- Job security provisions do not apply generally

Job security

- work under an indefinite - term contract
- If employed in a workplace with at least 50 employees
- can be lost 6 months of security
- set as an employee's responsibility

Accordancy work law

Full-time

- working 40 hours
- full rights and benefits

Part-time

- less than full-time
- 40 hours part-time
- Rights apply proportionally
- can be dismissed without notice

Accordancy working system

Probationary

- 2 months (probation)
- Employer cannot dismiss
- 15 days
- 1st and 2nd probationary periods

Regular work

- 1st and 2nd probationary periods
- 1st and 2nd probationary periods
- 1st and 2nd probationary periods

Special

On-call work

- 1st and 2nd probationary periods

Temporary

- 1st and 2nd probationary periods
- 1st and 2nd probationary periods
- 1st and 2nd probationary periods

Basic principles of labor law - obligations

Employer

- * Pay wages
- * Treat equally
- * Manage and organize
- * Ensure safety
- * Comply with labor law regulations

Employee

- * Perform duties diligently
- * Abide by law
- * Follow instructions
- * Obey work discipline
- * Comply with labor law

Fundamental changes in working conditions

- No need to work
- Appointed to working by employer with a business plan

Wages

Must be paid - working and may be determined daily, weekly, monthly or per year

- * Gross basic wage
- * Net basic wage
- * Gross wage including benefits
- * Net wage including benefits

Turkish Labor Rights Law (Law No. 4859) - increasing

Working hours

Working time (40 hours) - 1st and 2nd probationary periods

Rest periods

- * 1st and 2nd probationary periods
- * 1st and 2nd probationary periods

Over-time (exceeding 40 hours per week)

- * Compensation by monetary pay or time off (compensation)

Leaves

Annual paid leave granted after one year of service, may be used in parts

- * 1st and 2nd probationary periods
- * 1st and 2nd probationary periods

Public holidays

- Employed: do pay if they do not work
- If they work receive double pay

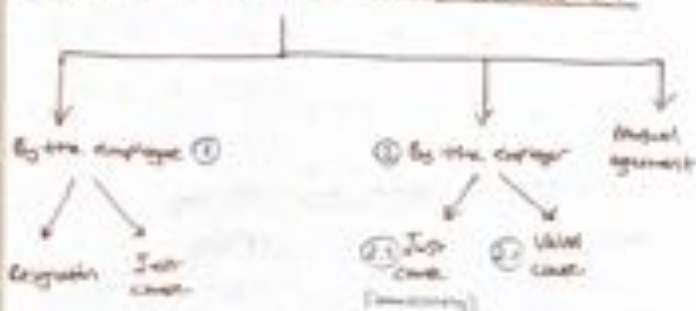
Family leave

- Marriage: death of close relative - today
- Birth of spouse - today

Maternity and sick leave

- Maternity: 8 weeks before and after birth (extended for multiple pregnancies)
- Sickness: 45 weeks early until child born and

Termination of Indefinite Employment Contracts



Dismissal reasons

- Causes that do not comply with laws and good faith
- Not and cause otherwise is a worthy thing after years of labour
- First argument is dismissal of both sides and work

②.1 → Business/employee own requirements

- Employee transfer
- Employee performance

②.2 → Valid reason

- Actions which cause and good faith protected
- Company reasons