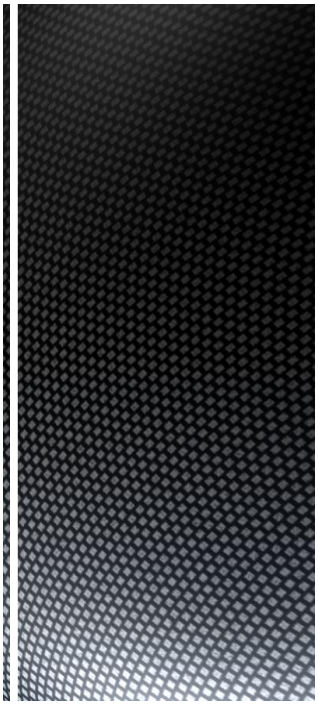
Automation (21-541)

Advanced Manufacturing Laboratory
Department of Industrial Engineering
Sharif University of Technology

Session # 12



Session Schedule

- *Computer-Aided Design (CAD)*
  - *Geometric modeling*
    - *Geometric data exchange*

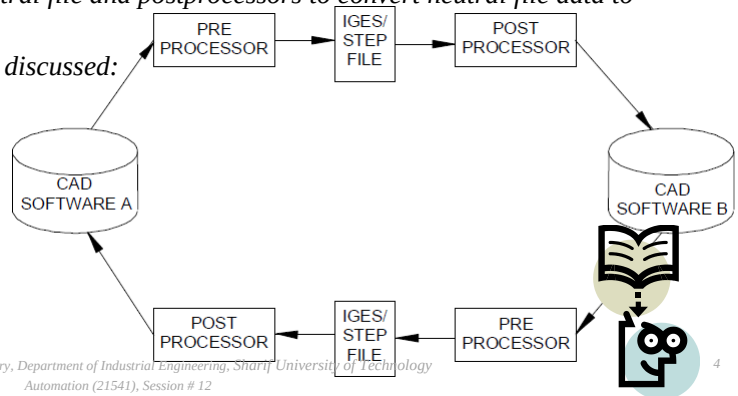
Computer-Aided Design (CAD)

- *Geometric data exchange*
  - *The heart of any CAD model is the component database.*

  This includes
  - *The graphics entities like points, lines, arcs, circles etc. and the co-ordinate points, which define the location of these entities.*
  - *This geometric data is used in all downstream applications of CAD, which include*
    - *Finite element modeling and analysis,*
    - *Process planning,*
    - *Estimation,*
    - *CNC programming,*
    - *Robot programming,*
    - *Programming of co-ordinate measuring machines,*
    - *ERP system programming and simulation.*

Computer-Aided Design (CAD)

- *Geometric data exchange*
  - *A solution to the problem of direct translators is to use neutral files.*
  - *These neutral files will have standard formats and software packages can have pre-processors to convert drawing data to neutral file and postprocessors to convert neutral file data to drawing file.*
  - *Three types of neutral files are discussed:*
    - *Drawing exchange files (DXF)*
    - *IGES files*
    - *STEP files*



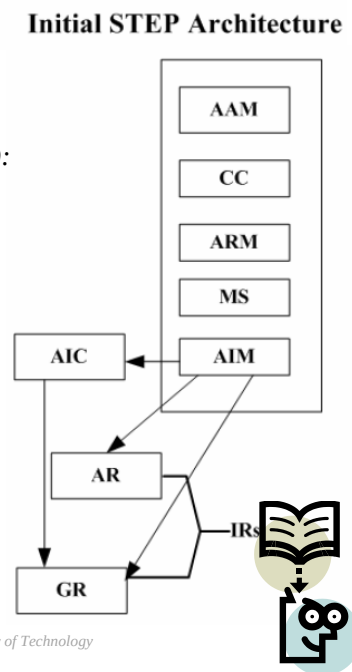
Computer-Aided Design (CAD)

- *Geometric data exchange*
  - *Standard for the Exchange of Product data (STEP, ISO 10303):*
    - *The STEP is the enabler for seamless exchange of product data which is critical to CAD/CAM/CAE systems.*
    - *STEP itself is the basis for Product Data Management System (PDM).*
    - *It covers border functionalities. It includes methods of representing all critical product specifications such as*
      - *Shape information,*
      - *Materials,*
      - *Tolerances,*
      - *Finishes and*
      - *Product structure.*

Computer-Aided Design (CAD)

- *Geometric data exchange*
  - *Standard for the Exchange of Product data (STEP, ISO 10303):*

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(
/* description */ ('A minimal AP214 example with a single part'),
/* implementation_level */ '2;1');
FILE_NAME(
/* name */ 'demo',
/* time_stamp */ '2003-12-27T11:57:53',
/* author */ ('Lothar Klein'),
/* organization */ ('LKSoft'),
/* preprocessor_version */ ' ',
/* originating_system */ 'IDA-STEP',
/* authorization */ ' ');
FILE_SCHEMA (('AUTOMOTIVE_DESIGN { 1 0 10303 214 2 1 1}'))
ENDSEC;
DATA;
#10=ORGANIZATION('O0001','LKSoft','company');
#11=PRODUCT_DEFINITION_CONTEXT('part definition',#12,'manufacturing');
#12=APPLICATION_CONTEXT('mechanical design');
#13=APPLICATION_PROTOCOL_DEFINITION(,'automotive_design',2003,#12);
#14=PRODUCT_DEFINITION('0',$,#15,#11);
#15=PRODUCT_DEFINITION_FORMATION('1',$,#16);
#16=PRODUCT('A0001','Test Part 1','',(#18));
#17=PRODUCT_RELATED_PRODUCT_CATEGORY('part',$,(#16));
#18=PRODUCT_CONTEXT('',#12,'');
#19=APPLIED_ORGANIZATION_ASSIGNMENT(#10,#20,(#16));
#20=ORGANIZATION_ROLE('id owner');
ENDSEC;
END-ISO-10303-21;
```



Computer-Aided Design (CAD)

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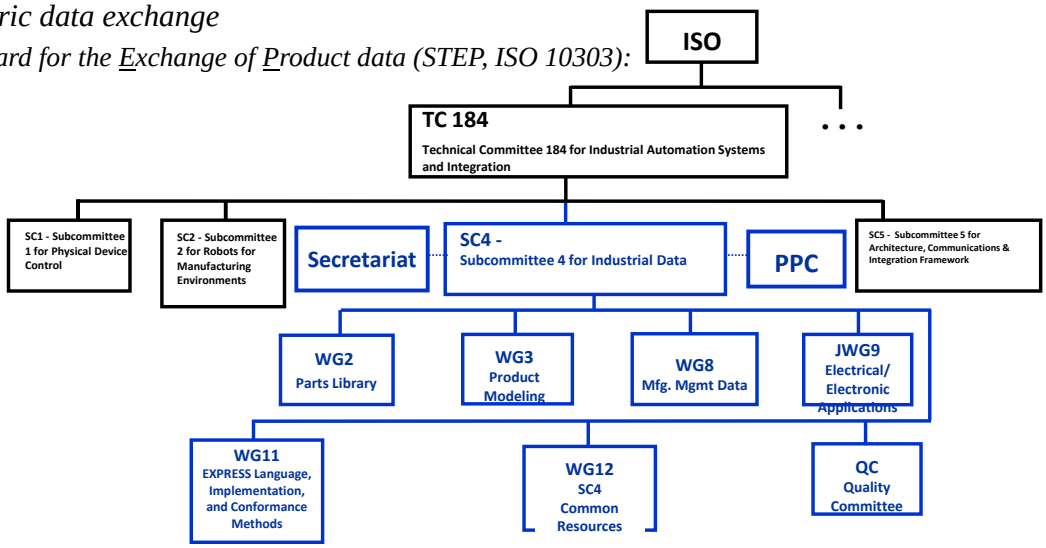

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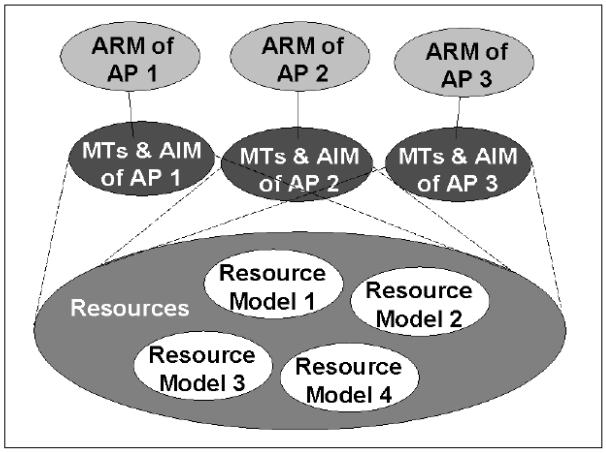
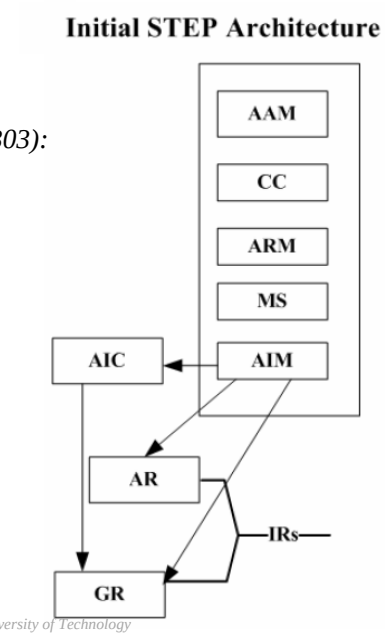
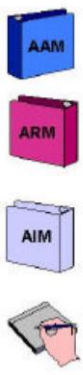




Computer-Aided Design (CAD)

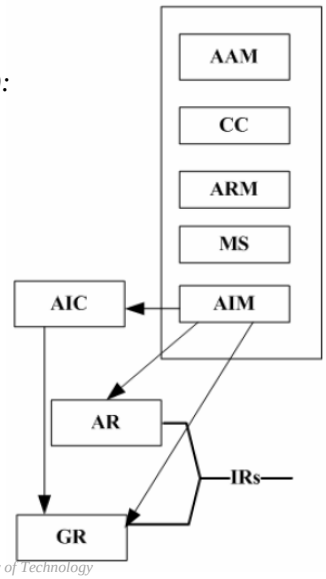
- *Geometric data exchange*
  - *Standard for the Exchange of Product data (STEP, ISO 10303):*

Contents of an Application Protocol



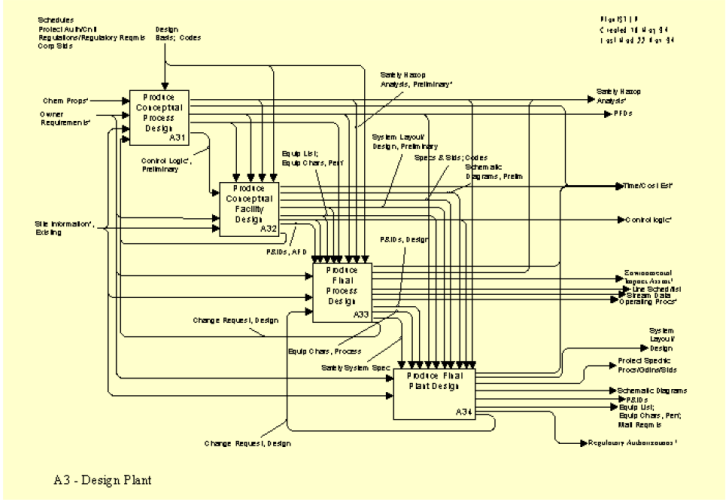
- **Application Activity Model**
  A function model that describes the activities and processes of defined application context domain. This is a requirement document.
- **Application Reference Model**
  An information model that describes the information requirements and constraints for an application context area. The model uses application-specific terminology and rules that are familiar to experts in the application area.
- **Application Interpreted Model**
  An information model that describes the STEP data structures required for functional equivalence with the application contexts' AAM's and ARM's.
- **Conformance Classes**
  Descriptions of the valid populations of the file, which serve to define conformant uses of the AP.

Initial STEP Architecture



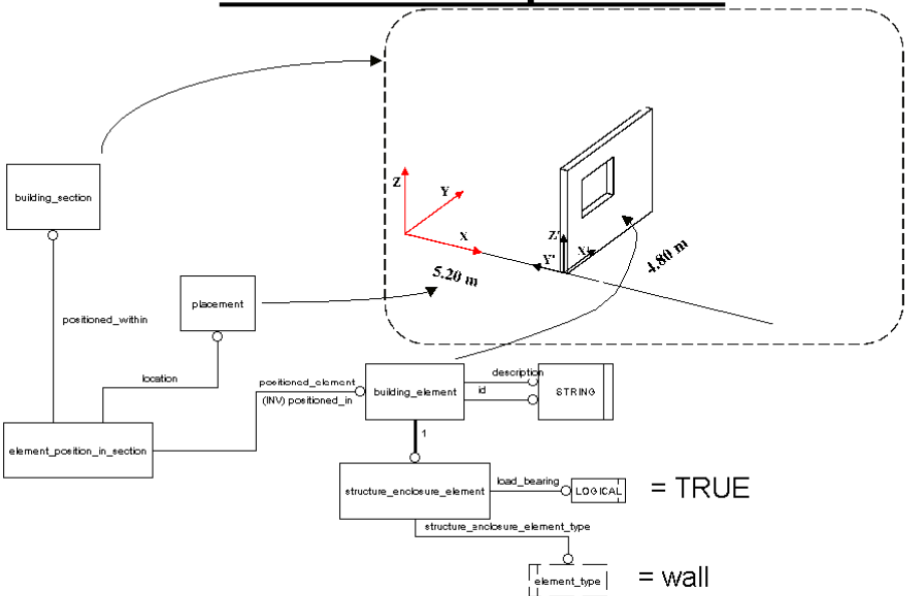
Application Activity Model (AAM)

Information "flows" between activities are the basis for development of ARM.



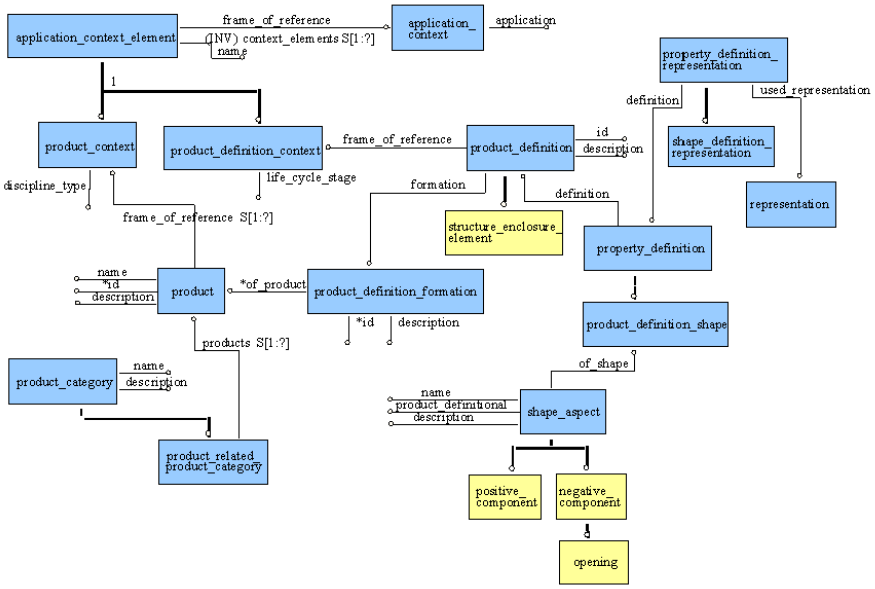
A3 - Design Plant

Example: ARM Relationship to Information Requirements

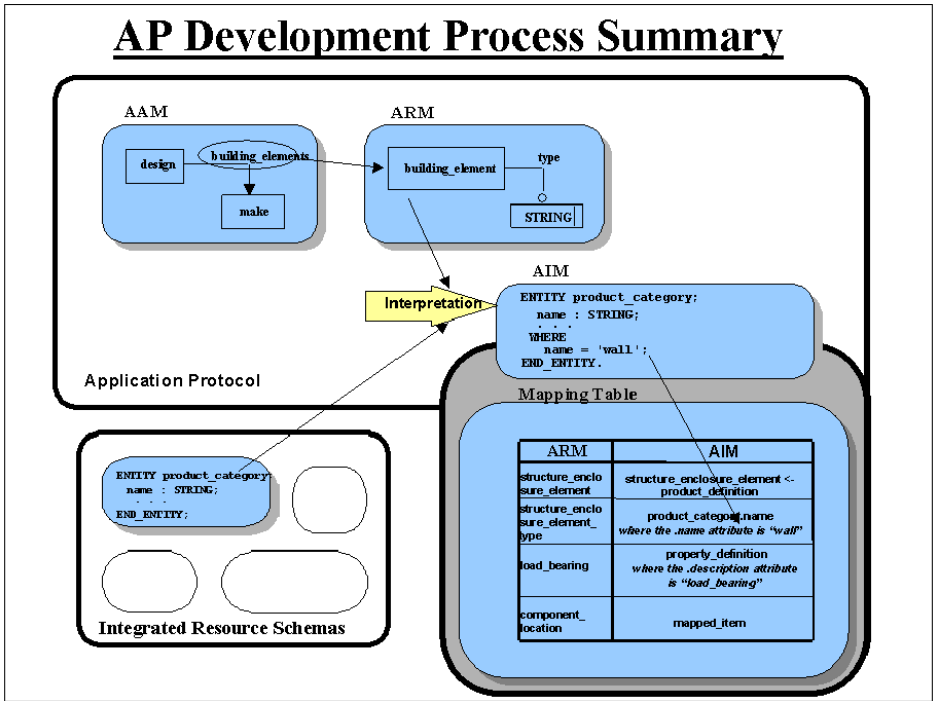


11

Example: AIM Fragment



12



13

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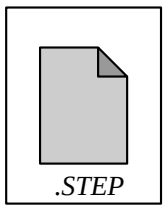

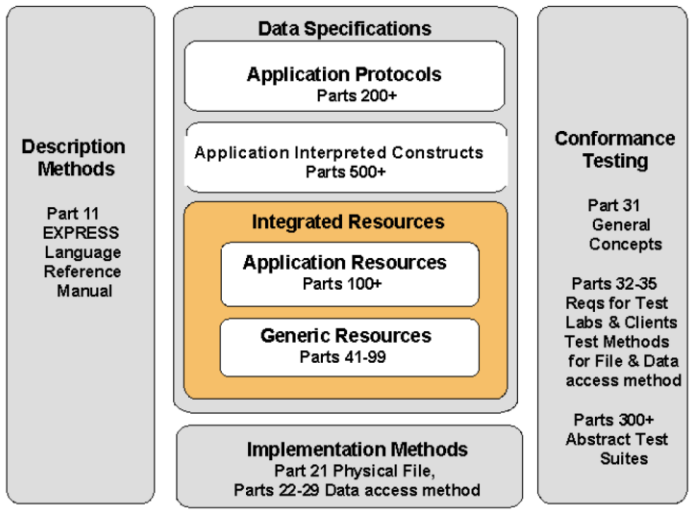

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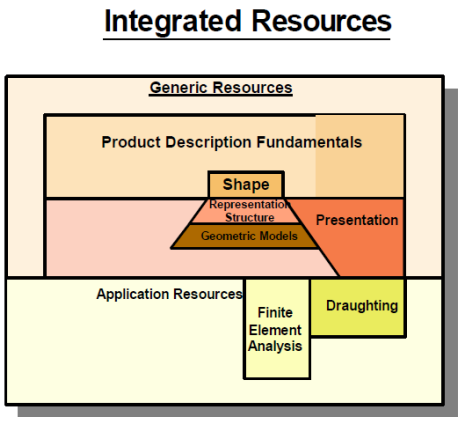

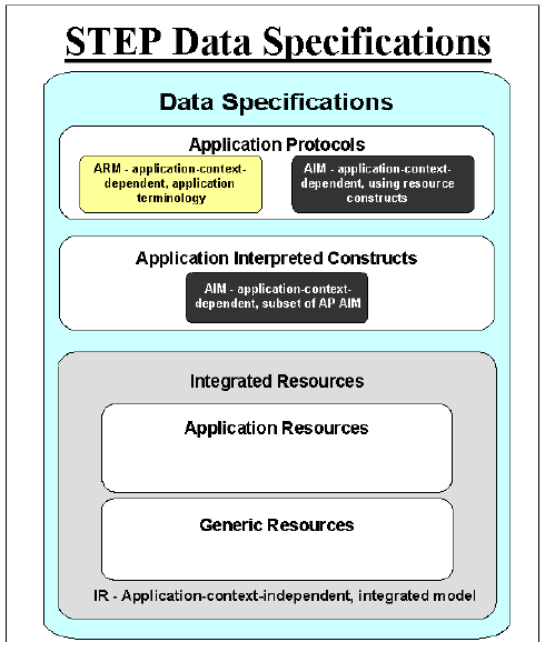

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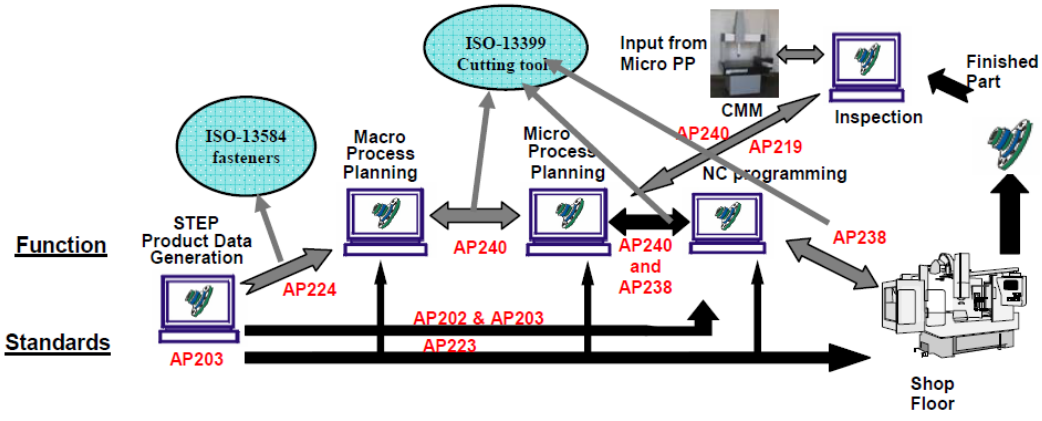

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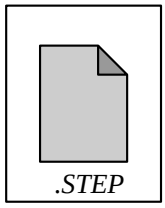
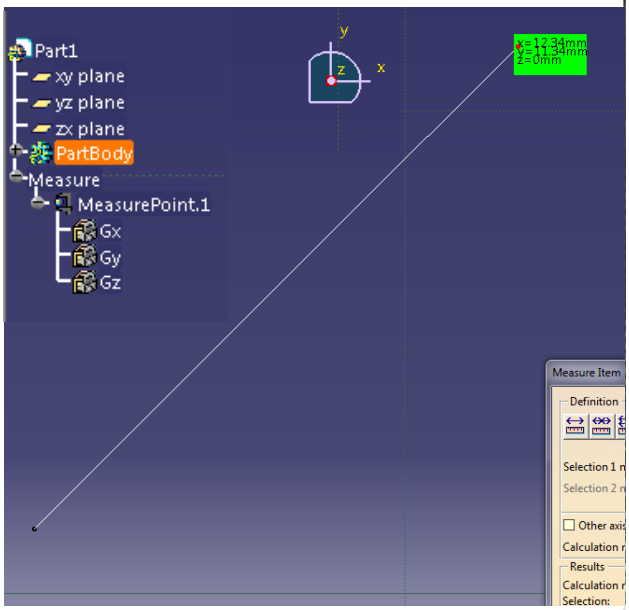
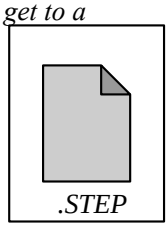




Homework # 11

- *In this HW you will try to analyze a simple example of STEP standard Integrated Resources (IRs):*
  - *Consider the following STEP file*
  - *Start from the "Cartesian_Point " entity and draw a simple Entity model till you get to a B-Rep model.*



- *The HW should be sent to omidf@ie.sharif.edu till Saturday, 30th of Azar (Dec, 21st ,2013)*
- *Email subject: "HW11:GroupCode"*