THE UNIVERSITY OF WESTERN ONTARIO
LONDON, CANADA

Computer Science 2212b
FINAL EXAMINATION

APRIL 22nd, 2016
180 minutes

Name:____

Instructions:

- Fill in your name above immediately.
- Have your student card out of its case on the desk.
- This is a closed book exam → There is reference material toward the end of the exam booklet.
- If you finish within 20 minutes of the end of the exam, you must wait until the exam ends before leaving so as not to distract those who are still working. You will lose marks if you leave during this time.
- There is a blank page at the back of this exam for rough work and additional space to answer questions if necessary. Additional sheets can be provided upon request. All paper must be returned with your exam.
- No electronic devices are allowed.
- Please turn off your cell phone and remove it from your desk or person (it cannot be in your pocket).
- **DO NOT TURN THIS PAGE UNTIL DIRECTED TO DO SO**

Question	**Out Of**	**Mark**
MC	30	
1	5	
2	6	
3	12	
4	4	
5	5	
6	5	
7	6	
8	6	
9	6	
10	4	
11	3	
12	3	
13	20	
14	15	
15	20	
Total	150	

Student Number:____

PART 1 – Multiple Choice 30 marks

Answer the following questions directly on the exam paper.
There is intended to be only ONE correct answer per questions.
Questions are worth 1 mark each unless otherwise indicated.

1) Which of the following statements is/are true about User Stories?

   i. They help developers agree on the technical details of the project
   ii. The aim to capture only the requirements connected to Users/Clients
   iii. They are written as specifically and technically as possible, to ensure effective communication
   iv. They aid in the prioritization and scheduling of developer tasks

   a) ii and iv
   b) iii
   c) i and iii
   d) ii and iii
   e) All of the above statements are correct

2) In software process management, we talked about the optimistic approach. Which of the following statements is/are true about the optimistic approach?
   a) It can make estimating the delivery time difficult
   b) There is no recognition of the need for systematic testing
   c) It carries a high amount of risk
   d) It does not include a design step
   e) All of the above statements are correct

3) Agile methodologies embrace which of the following?
   a) Short iterations
   b) High amount of user/client involvement at all stages
   c) Documentation of all steps in written reports for maintainability
   d) Two of the above are correct
   e) All of the above are correct

4) In user interface design, what is meant by “mode”?
   a) The current window receiving input from the user
   b) Changing how user input is interpreted during execution
   c) The way the screen is laid out and how the components behave
   d) Adhering to the principle of “Permit reversal of actions”
   e) Users interacting with the system using inputs from a different system

5) Which of the following is an accurate definition of development effort with respect to cost estimation?

a) The amount of time from the beginning of the project to the released date, in hours.
b) The efficiency of the developers in lines/hour.
c) The efficiency of the developers measured in the velocity of their Sprints.
d) The total amount of employed developer hours in man-hours.
e) None of the above are correct

6) In project management, what is the difference between scheduling and tracking?

a) Scheduling involves how to order the tasks, whereas tracking is making sure the tasks are completed on time
b) Scheduling correctly will ensure tasks are completed on time, whereas tracking is useful only to the developers to ensure they are on track with the schedule
c) Scheduling takes a large amount of effort, whereas tracking is a much faster process
d) Scheduling involves cost-estimation and the order of the tasks, whereas tracking is only part of the scheduling process
e) None of the above accurately describe a difference between scheduling and tracking

7) What is the *main* reason the turnover of employees pose is a risk to projects?

a) Their code may not be understood by the new employee
b) Their code may not be understood by any other employees
c) Their code may be undocumented
d) They may have deliberately created a security vulnerability
e) None of the above are the main risk

8) Which of the following are benefits of UI design?

i. It can increase the efficiency of the systems processes
ii. It can decrease the training time for new users
iii. It can increase the utility of the system
iv. It can decrease the overall development cost

a) ii and iv
b) iii
c) i and iii
d) ii and iii
e) All of the above statements are correct

9) What is the difference between a user’s tasks and a user’s goals?

a) The user’s tasks are their required contribution to the development effort, whereas their goal is the finished product
b) The user’s tasks are the steps required by the user when using the software, whereas their goal is what they want to accomplish with the software
c) The user’s tasks are harder to define than their goals
d) The user’s tasks are outlined by their focus group moderator, their goal is the payment for participating in the focus group
e) None of the above describe the difference between the user’s tasks and goals.

10) Providing the user with context and feedback includes which of the following?

a) Having the system state visible
b) Having the system mode visible or otherwise obvious
c) Having the available commands visible
d) Making use of hover-over tool tips
e) All of the above are correct

11) When you do not save a file correctly in Word, a recovered version is available upon restart. This is a great example of which principle of usability?

a) Reversibility of actions
b) Providing all necessary help
c) Tasks achievable through a simple set of actions
d) Provide user with context and feedback
e) None of the above are correct

12) When designing a user interface, why is it important to consider a user’s mental model

a) The presentation and UI of the system will affect how the user perceives how good the system looks and feels
b) Users want to be able to easily achieve their goals. If the design is good, they will achieve their goals and their model of the system will be positive
c) The user’s mental model is mostly controlled by the device or system they are using, as it defines their physical inputs and outputs, so the choice of device(s) and OS(s) should be carefully considered
d) The user’s mental model is used to predict plans of actions. The usability of the system will increase if the predicted actions are close to the actual actions required of the user

13) A text-based interface could include which of the following?

a) Command line arguments
b) Interactive prompts in a shell
c) Menu systems navigable by arrow keys
d) Keyboard shortcuts
e) All of the above are true

14) Which of the following are benefits of using metaphors in UI design?

i. Metaphors draw on existing knowledge of the user

ii. Metaphors oversimplify the utility of the program

iii. Metaphors make the system more intuitive and more learnable

iv. Metaphors, through their appearance, suggest the actions that can be performed on them

a) ii and iv
b) iii
c) i and iii
d) ii and iii
e) All of the above statements are correct

15) What is the type of interface mainly used by traditional - box and monitor - desktop computers?
a) Text-based
b) Graphical User Interface
c) Windows, Icons, Menus and Pointers (WIMP)
d) Post WIMP
e) None of the above are true

16) In UI Design, what is the definition for the term focus?
a) The current association between action and response
b) The currently active set of available commands
c) The currently active peripheral input device
d) The most important open program
e) None of the above are correct definitions of focus

17) How are software architecture design (SAD) and object-oriented design (OOD) different?
a) SAD can only happen after OOD is complete
b) SAD is about how subsystems, containing many potential classes, are organized, whereas OOD is about how classes themselves are organized
c) The OOD should not be SAD
d) SAD is about the physical systems, whereas OOD is about the program
e) None of the above are correct

18) Why do designers use models?
a) The models are cheaper than prototypes
b) They can communicate complex ideas through standard notation
c) The models provide abstraction for the purpose of design
d) The models provide documentation of the system
e) All of the above are true

19) Which of the following is a difference between a superclass and a Java interface?

i. The superclass can have attributes, but an interface cannot

ii. The subclass can inherit from multiple superclasses, but can only implement one interface

iii. The superclass defines methods that do not have to be overridden in all subclasses, but the interface methods must be overridden

iv. The superclass defines a common interface for all its subclasses, but an interface does not define a common interface for all the classes implementing it

a) ii and iv
b) iii
c) i and iii
d) ii and iii
e) All of the above statements are correct

20) Which of the following is/are a sign of low cohesion?
a) Accesses or modifies private data from another class
b) The class uses global variables or singletons
c) The class has a clearly defined purpose
d) There are several groups of functions each centered around distinct sets of attributes within the class
e) None of the above are true

21) Which of the following are good candidates for composition (rather than aggregation)

i. A team and it's players in a multiplayer game

ii. A user and their achievements

iii. A scheduled train trip and it's ticketed passengers

iv. A UI window and it's buttons and labels

a) ii and iv
b) iii
c) i and iii
d) ii and iii
e) All of the above statements are correct

22) How is domain analysis valuable to the requirements engineering process?
a) Research spikes can lead developers to anticipate the users needs and extensions they might want
b) Bringing in a domain expert can improve communication between stakeholders
c) Developers having accurate knowledge of the context of the program will lead to fewer mistakes in its functionality; It will be more likely that they interpret requirements correctly
d) The system overall is likely to be better
e) All of the above are correct

23) When using git, which of the following would correctly include the new file NewSource.java in the repo and upload it to Bitbucket, assuming the ssh key and repo have been made?

a) git add NewSource.java
   git commit –m “Added NewSource.java”

b) git add .
   git commit –m “Added NewSource.java”
   git push

c) git add NewSource.java
   git merge

d) git commit –m “Added NewSource.java”
   git push

e) git add NewSource.java
   commit –m “Added NewSource.java”
   git merge

24) Git and Bitbucket are the same in which of the following ways?

i. They both allow the creation of branches

ii. They both allow branch specific permissions

iii. They both allow two branches to be merged

iv. They both are hosted remotely

a) ii and iv
b) iii
c) i and iii
d) ii and iii
e) All of the above statements are correct

25) Which of the following statements about Git is/are true?

i. Files can be hidden

ii. Files can be ignored

iii. Files can be staged

iv. Files can be untracked

a) ii and iv
b) iii
c) i and iii
d) ii and iii
e) All of the above statements are correct

26) Java object serialization is used for what reason?

a) To store the state of all objects in a program into an executable binary
b) To store all the data from an object into a file
c) To store selected data from an object into memory
d) To allow program versioning
e) None of the above are correct

27) To serialize a single object, what steps should be taken?

i. The class should have “implements Serializable” in its definition

ii. The class should use a version ID

iii. The class must have a default constructor

iv. The object must be put into an ObjectOutputStream

a) ii and iv
b) iii
c) i and iii
d) ii and iii
e) All of the above statements are correct

28) Which of the following statements about Maven is/are true?

a) It favours configuration over convention
b) It assumes a specific directory structure
c) It is configured using command line options
d) It performs continuous integration
e) Two of the above statements are true

29) What is the difference between the jar which includes dependencies and a jar without dependencies, built using mvn package?

i. Only jars without dependencies are platform independent

ii. Only jars that include dependancies will have copies of the files in src/main/resources

iii. Only jars that include the dependencies are called fat jars

iv. Only jars without dependencies can be created with mvn package

a) ii and iv
b) iii
c) i and iii
d) ii and iii
e) All of the above statements are correct

30) Which of the following statements about JUnit testing is/are true?

a) JUnit testing is integrated into git
b) JUnit tests are considered integration tests
c) JUnit tests are black box tests
d) JUnit test cases can be run automatically by Maven
e) None of the above are true

PART 2 – Written Answer – 120 marks

For the following questions, please write your answers in the space provided.
Long answer questions are toward the end.

1) [5 marks] Give a definition for software engineering.

2) [6 marks] Given the seven aspects of software design quality:

   a. select 2 that are more important to users than to developers. Briefly explain your choices.

   b. select 1 that is important to real-time systems and briefly explain your choice.

3) [12 marks] Given the seven aspects of software design quality, select one which would be the most important and one which would be the least important for the following systems, and briefly explain each choice.

   a. An order tracking and billing software used in a restaurant by servers.

   b. The internal computer control systems of a car, which control the engine, transmission, rolling up windows, unlocking doors, braking, etc.

4) [4 marks] When considering the tradeoffs of the seven aspects of software design quality, if we work to improve efficiency, what two other aspects might suffer and why? You may indicate how efficiency was improved in an example to motivate your choices.

5) [5 marks] Which of the seven aspects of software design quality is *most negatively* impacted by highly coupled code? Include a brief definition of highly coupled code in your answer, and briefly justify your choice by speaking to how it is impacted by highly coupled code.

6) [5 marks] What is an appropriate software process model for an eight-person, undergraduate programming assignment (1 marks)? Justify your answer with at least two arguments (4 marks).

7) [6 marks] Explain how contingency planning differs from risk mitigation, and give an example. Include a definition of each, how they differ from each other, and an example for each that demonstrates this.

8) [6 marks] Given the sources of risk discussed in class, identify 2 leading sources (2 marks) of risk in the following scenario, and justify each choice (4 marks): IT consulting/development company (which is fairly general, working on many types of commissioned projects) creating a milk-production tracking and optimization system for a large dairy farming operation with a team of 10 employees.

9) [6 marks] For the following, identify if it is an example of a functional (write an F) or non-functional (write an N) requirement:

   a. The program must include JUnit testing.

   b. The program must have a splash screen while loading.

   c. The program needs to be attractive and follow graphic design principles.

   d. The program will communicate with several APIs.

   e. The program development will follow Agile Scrum process model.

   f. The program must build using Maven software.

10) [4 marks] For the following set of User Stories, identify the INVEST principle that they violate, and provide a better set of stories.

a. The user can view their daily calories

b. The user can view their daily steps

c. The user can view their daily floors

d. The user can view their daily active minutes

e. The user can view their daily sedentary minutes

11) [3 marks] What is redundancy gain? Give a definition [1 mark] and an example with an explanation of why it exemplifies redundancy gain [1 mark for using a traffic light, 2 for your own].

12) [3 marks] Consider the tabbed pane element common to UIs (the tabs in a browser for example). Classify the following descriptions as either “look” (write an L) or “feel”(write an F) properties:

a. On one system the active one is a brighter color than the other tabs, and on another system the tab is the only one connected to the current frames border.

b. On one system, you can click and drag a tab to reorder the tabs, on another system you can’t.

c. On one system they are round, and on another they are square.

13)[20 marks] Use the following class definitions to answer questions on the following page.

```
public class Date {
    public enum DateFormat{DDMMYYYY, MMDDYYYY_DASHED, DDMMYY_SLASHED};
    private int day;
    private int month;
    private int year;
    private DateFormat defaultFormat = DateFormat.DDMMYYYY;
    private DateFormat outputFormat = defaultFormat;

    public Date(String dateString){  this.setDate(dateString);   }
    public void setDate(String dateString) {  this.setDate(dateString, defaultFormat);  }

    public void setDate(String dateString, DateFormat dateFormat){
        switch(dateFormat)  {
        case DDMMYYYY:
            this.day = Integer.parseInt(dateString.substring(0,2));
            this.month = Integer.parseInt(dateString.substring(2,4));
            this.year = Integer.parseInt(dateString.substring(4));
            break;
        case MMDDYYYY_DASHED:
            this.day = Integer.parseInt(dateString.substring(3,5));
            this.month = Integer.parseInt(dateString.substring(0,2));
            this.year = Integer.parseInt(dateString.substring(6));
            break;
        case DDMMYY_SLASHED:
            System.out.println("Cannot figure out the year!");
            break;
        default:
            // cannot reach
    }}
    public void setToStringFormat(DateFormat dateFormat){  this.outputFormat = dateFormat;  }

    public String toString(){
        String toReturn="";
        switch(this.outputFormat){
        case DDMMYYYY:
            toReturn = String.format("%02d%02d%4d", this.day, this.month, this.year);
            break;
        case MMDDYYYY_DASHED:
            toReturn = String.format("%02d-%02d-%4d", this.day, this.month, this.year);
            break;
        case DDMMYY_SLASHED:
            toReturn = String.format("%02d/%02d/%2d", this.day, this.month, this.year%100);
            break;
        default:
            toReturn = "";
        }
        return toReturn;
    }}
}
```

This page is intentionally left blank for rough work or extra space for answers.
Additional pages are available upon request

```
public class Main {
        public static void main(String args[]){

                Date finalExam = new Date("22042016");
                System.out.println(finalExam);

                finalExam.setDate("04-26-2016", Date.DateFormat.MMDDYYYY_DASHED);
                finalExam.setToStringFormat(Date.DateFormat.DDMMYY_SLASHED);
                System.out.println(finalExam);
        }
}
```

The above main method produces the following output:

```
22042016
26/04/16
```

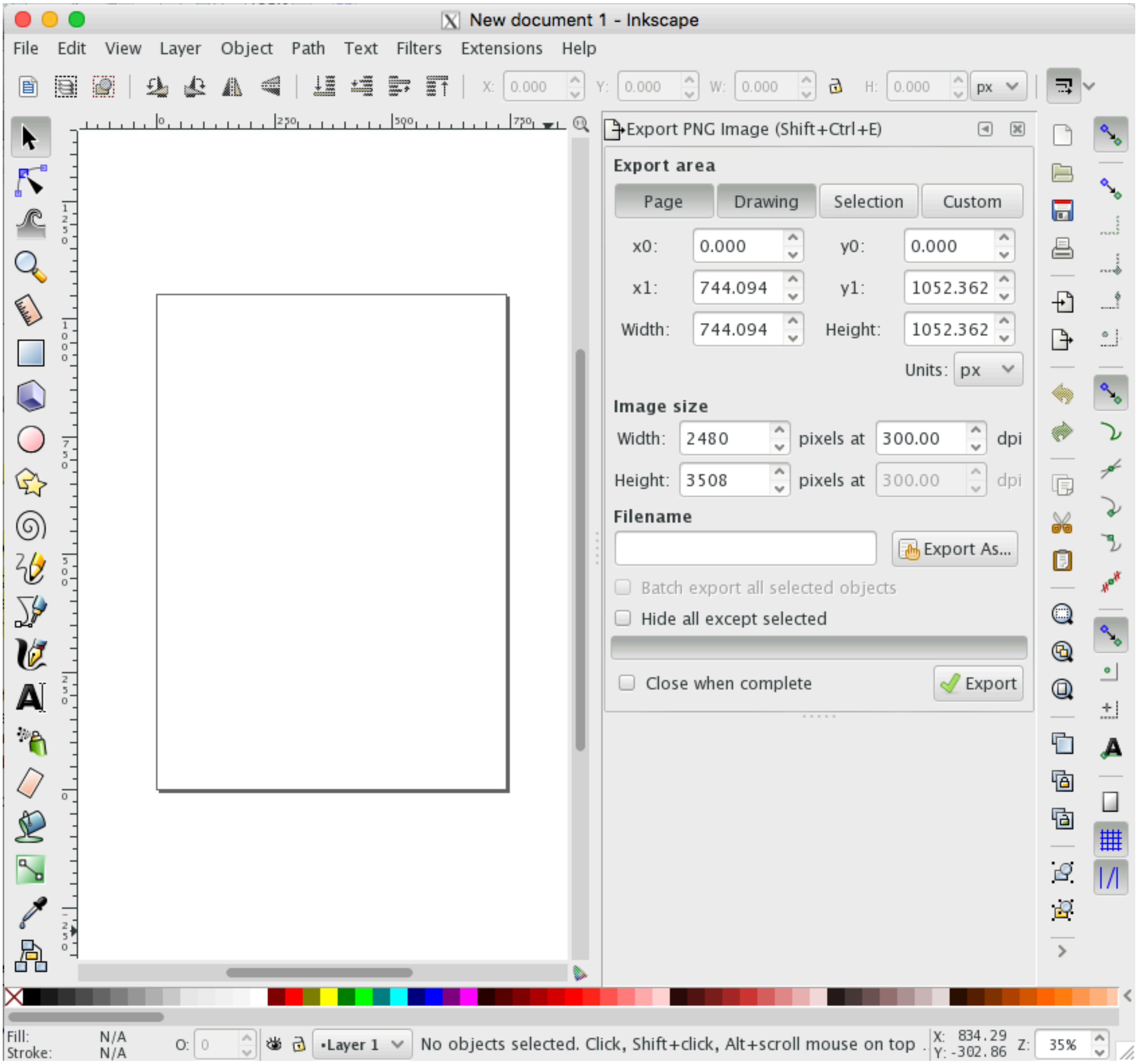
a. [2 marks] Identify the design principle it violates that you will address, citing specific examples from the code.

b. [2 marks] Why is this an issue for the program's design? Cite a specific situation (which can include any modifications needed at a later time in the system).

c. [6 marks] Create a UML class diagram showing a better design, including all members

d. [6 marks] Provide a description of how your design addresses the issues of the original implementation and any benefits of the newer system over the old system.

14)[15 marks] The following is the main user interface of the graphics editor Inkscape:



X: 0.000 Y: 0.000 W: 0.000 H: 0.000 px

Export PNG Image (Shift+Ctrl+E)

Export area

Page | Drawing | Selection | Custom

x0: 0.000 y0: 0.000

x1: 744.094 y1: 1052.362

Width: 744.094 Height: 1052.362

Units: px

Image size

Width: 2480 pixels at 300.00 dpi

Height: 3508 pixels at 300.00 dpi

Filename

Export As...

□ Batch export all selected objects

□ Hide all except selected

□ Close when complete

Export

Fill: N/A
Stroke: N/A
O: 0
•Layer 1
No objects selected. Click, Shift+click, Alt+scroll mouse on top .
X: 834.29
Y: -302.86
Z: 35%

a. [4 marks] List 2 metaphors they make use of in their conceptual model. Why are these metaphors helpful to usability?

b. [3 marks] Indentify a GUI component that relies on affordance, rather than specific directions to the user, and justify your selection. Give the definition of affordance as part of your answer.

c. [8 marks] Identify 2 GUI design principles they adhere to, and 2 they could do better on, citing specific examples in the given GUI components, and justify your selections.

15)[20 marks] Consider the following method:

```
public static boolean pantSizeValid(int size){
        if(size >= 26 && ( size < 34 || size <= 42 && size % 2 == 0) )
                return true;
        return false;
}
```

a. (10 marks) Draw a program flowchart (with each of the four conditions separated into individual diamond nodes) representing the above method.

Start

return false

return true

b. (5 marks) Give a minimal set of input(s) to test Multiple Condition Coverage.

c. (5 marks) Below is a snippet of the JUnit test program for the above method. Add a test method which will test one of the *edge cases* from the above example.

   Note: you can have multiple assertions in a single test method.

```
public class TestPantSize {
        @Test
        public void testValidPantSize() {
                assertTrue(PantSize.pantSizeValid(32));
        }

        @Test
        public void testInvalidPantSize() {
                assertFalse(PantSize.pantSizeValid(35));
        }
















}
```

Reference Material

Topic 1

Seven aspects of design quality

- Usability
- Efficiency
- Compatibility
- Reliability
- Maintainability
- Security
- Reusability

Software Project Activities

- Requirements and specification
- Design
- Modeling
- Programming
- Quality assurance
- Deployment
- Management of the process

Topic 2

Software Process Models

- General approaches for organizing a project into activities.
    - Waterfall
    - Spiral (Iterative)
    - Agile – eXtreme Programming / Scrum

Principles of Cost Estimation

- Divide and conquer
- Include all activities
- Base your estimates on past experiences combined with knowledge of current project
- Be sure to account for project differences when extrapolating from past projects
- Anticipate the worst case and plan for contingencies
- Combine multiple independent estimates
- Revise estimates as work progresses

Risk Management Activities

1. Risk discovery
2. Exposure analysis
3. Contingency planning
4. Mitigation
5. Ongoing monitoring

Risk Sources

- Schedule flaws/Under sizing
- Requirements inflation
- Turnover of employees
- Specification Breakdown (cancellation)
- Under performance
- New methodology/platforms
- Special skills shortage
- Resource shortage

Topic 3

Usability Ideals

- easy to learn
- easy to remember how to use
- effective and efficient
- prevents/handles user errors
- system state is visible

Principles of Usability

1. Do not rely on usability guidelines
2. Base UI design on users' tasks
3. Task should be achievable through simple sets of actions
4. Provide user with context and informative feedback
5. Offer error prevention and handling
6. Permit reversal of actions
7. Ensure that response time is adequate
8. Simplify information presented
9. Provide all necessary help
10. Be consistent

Topic 4

Software Design Principles

- Low Coupling
- High Cohesion
- Encapsulate what varies
- Code to an interface, not an implementation
- Favour composition over inheritance

Design Patterns

- Model View Controller
- Singleton

Topic 5

INVEST - Principles of Good User Stories

- Independent
- Negotiable
- Valuable
- Estimable
- Small
- Testable

Topic 6

Types of Testing

- Acceptance testing
- End-to-end testing
- Integration testing
- Unit testing

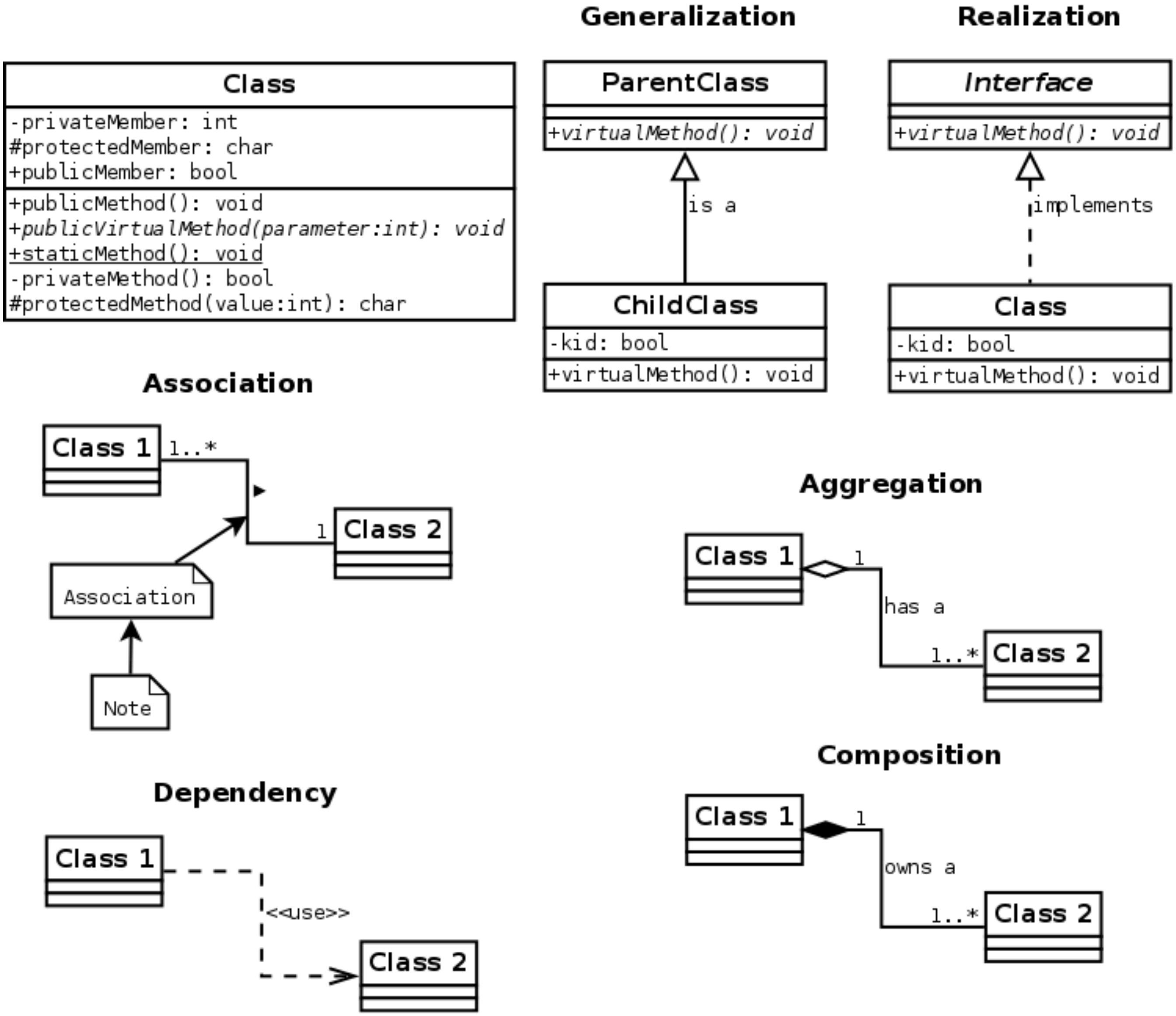
Levels of Code Coverage (Structural Testing)

- Statement/Line
- Branch/Edge
- Condition
- Multiple condition
- Path

Functional Testing

- Test all possible outputs
- Test both valid and invalid inputs
- Test around boundaries
- Test extreme values
- Test input syntax
- Guess at possible errors

UML Class Diagram Cheat Sheet



Generalization

Realization

Association

Aggregation

Composition

Dependency

Note: Java does not specify virtual methods like other languages – ie. You do not need to worry about using italics

Please use the <<interface>> notation in the title portion of any Interfaces.

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Additional pages are available upon request.

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