UCT Department of Computer Science
Computer Science 1015F

Introduction to Computing

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Computer Science in Context

5 Branches of Computing

- Computer Science
  - Foundations and principles
- Information Systems
  - Business processes & information
- Computer Engineering
  - Hardware and communications
- Software Engineering
  - Software development processes
- Information Technology
  - Application of computing

IT Prog. – Most specialisations

IT Prog. – Bus. computing
IS

IT Prog. – Computer eng.
EE/CE

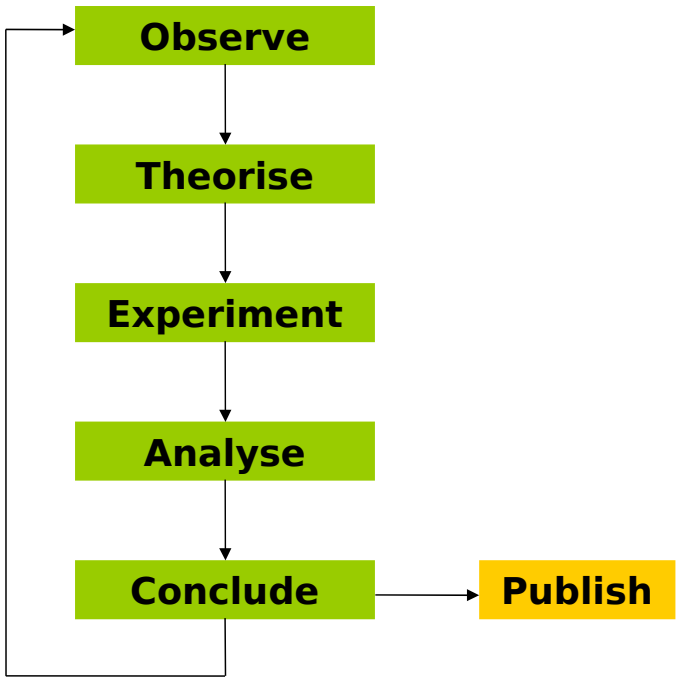
IS

CS Postgraduate

Reference: ACM Computing Curricula: Overview

What is a Researcher / Scientist?

- A researcher generates/locates knowledge.
- A scientist generates/locates knowledge using the scientific method.



Careers in Computing 1/3

the business place

Database & Technical Manager

The Business Place is a young, dynamic organisation dedicated to helping clients start or expand small businesses. The successful candidate will have excellent database querying, project management and IT skills. They will also be a self-starter able to take their own initiative.

Key Deliverables

- Creation of standard & adhoc reports from database.
- User and technical support for database throughout TBP.
- Overseeing quality assurance of data in the database.
- Project managing renewal of TBP website.

Minimum Qualifications and Experience

- IT related qualification plus five years work experience in IT.
- Experience of relational databases, particularly querying, report writing and data management.
- Hands on and practical approach.

This position is based at the Marshall Street office of The Business Place with some travel to other sites nationally. It is a one year fixed term contract with the possibility of renewal.

Please email all CVs to: Julie Machin, juliem@tbp.co.za by Monday 19 February 2007. If you have not heard from us within 30 days, please accept that your application was unsuccessful.

Careers in Computing 2/3

February 2007.

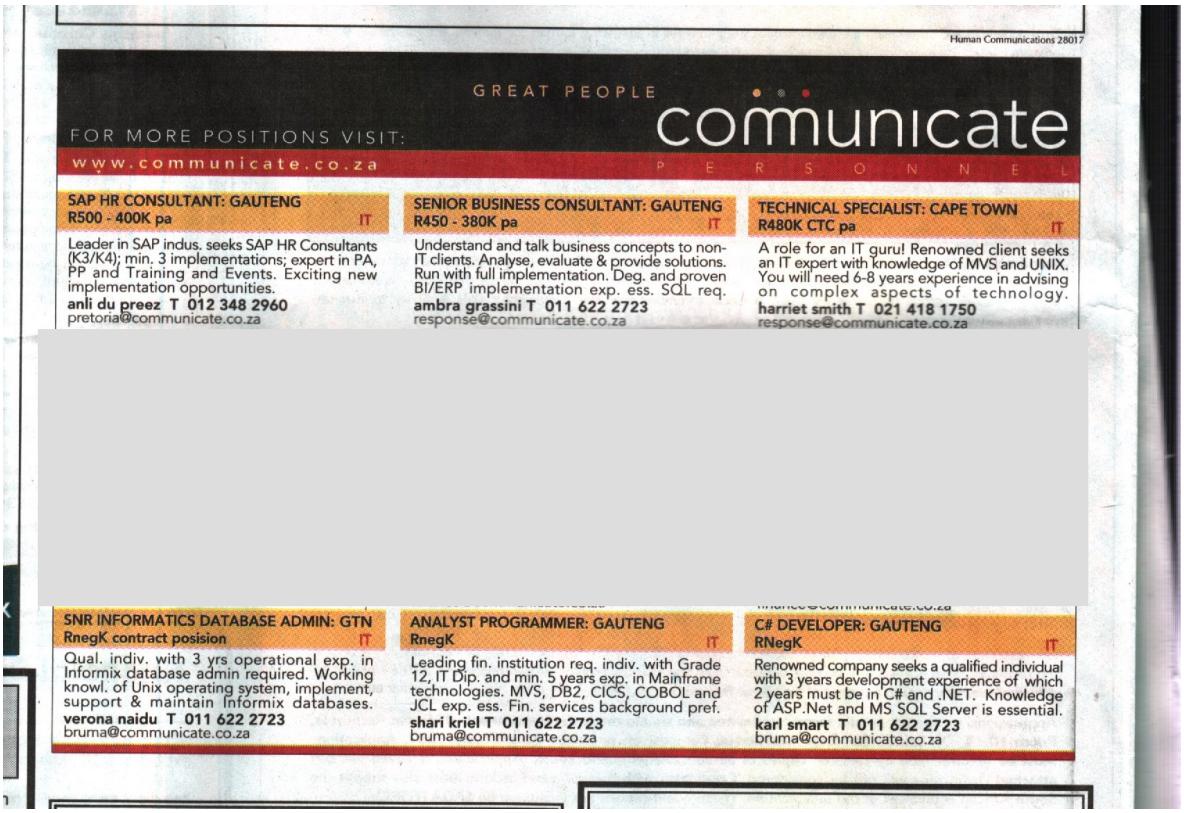
Adcorp Talent Resourcing 14996/07

MICROSOFT DEVELOPERS REQUIRED

Maintenance Developers to maintain and enhance web based Portal and Back Office application in an exciting and leading transactional environment - substantial opportunity for growth and enhancement. Strong brand in the motor industry. Candidates should have Visual Studio 2005, ASP.Net, SQL Server 2000/2005, TransactSQL experience. OO experience an advantage. Degree preferred, alternatively MS certified plus **minimum 2-3 years experience** on commercial applications.

Email CV to **jobs@Gallardo.co.za** or call **011 575 6528** (o/h) for a confidential discussion.

Careers in Computing 3/3



Human Communications 28017

GREAT PEOPLE

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www.communicate.co.za

communicate PERSONNEL

SAP HR CONSULTANT: GAUTENG
R500 - 400K pa IT

Leader in SAP indus. seeks SAP HR Consultants (K3/K4); min. 3 implementations; expert in PA, PP and Training and Events. Exciting new implementation opportunities.
anli du preez T 012 348 2960
pretoria@communicate.co.za

SENIOR BUSINESS CONSULTANT: GAUTENG
R450 - 380K pa IT

Understand and talk business concepts to non-IT clients. Analyse, evaluate & provide solutions. Run with full implementation. Deg. and proven BI/ERP implementation exp. ess. SQL req.
ambra grassini T 011 622 2723
response@communicate.co.za

TECHNICAL SPECIALIST: CAPE TOWN
R480K CTC pa IT

A role for an IT guru! Renowned client seeks an IT expert with knowledge of MVS and UNIX. You will need 6-8 years experience in advising on complex aspects of technology.
harriet smith T 021 418 1750
response@communicate.co.za

SNR INFORMATICS DATABASE ADMIN: GTN
RnegK contract posision IT

Qual. indiv. with 3 yrs operational exp. in Informix database admin required. Working knowl. of Unix operating system, implement, support & maintain Informix databases.
verona naidu T 011 622 2723
bruma@communicate.co.za

ANALYST PROGRAMMER: GAUTENG
RnegK IT

Leading fin. institution req. indiv. with Grade 12, IT Dip. and min. 5 years exp. in Mainframe technologies. MVS, DB2, CICS, COBOL and JCL exp. ess. Fin. services background pref.
shari kriel T 011 622 2723
bruma@communicate.co.za

C# DEVELOPER: GAUTENG
RNegK IT

Renowned company seeks a qualified individual with 3 years development experience of which 2 years must be in C# and .NET. Knowledge of ASP.Net and MS SQL Server is essential.
karl smart T 011 622 2723
bruma@communicate.co.za

Qualifications/Degrees

- Diploma
  - Learn about core technology and application
- Bachelors
  - Learn about principles and core technology
- Bachelors (Honours)
  - Learn about advanced technology and how to interpret research
- Masters
  - Learn how to do research
- Doctorate
  - Make significant new contribution to human knowledge

- Industry Certifications : CCNA, MCSE, etc.
  - Learn about specific technology and application

- Computing College Diplomas
  - Learn about core/specific technology and application

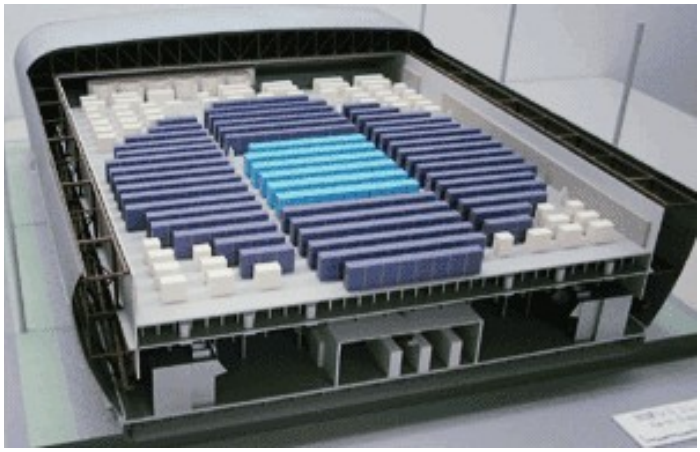
Computing at UCT

- Department of Computer Science (Science Faculty)
  - Offers BSc degrees in Computer Science (with various specialisations)
- Department of Information Systems (Commerce Faculty)
  - Offers BCom degrees and BBusSci degrees in Information Systems
- Department of Electrical Engineering (Engineering Faculty)
  - Offers BSc (Eng) degrees in Electronic Engineering or Computer Engineering

What is Computer Science

Why Computing is Important 1/5

- Earth Simulator Centre in Japan provides advance notice of natural disasters to preserve human life!



Reference: http://www.es.jamstec.go.jp/esc/eng/

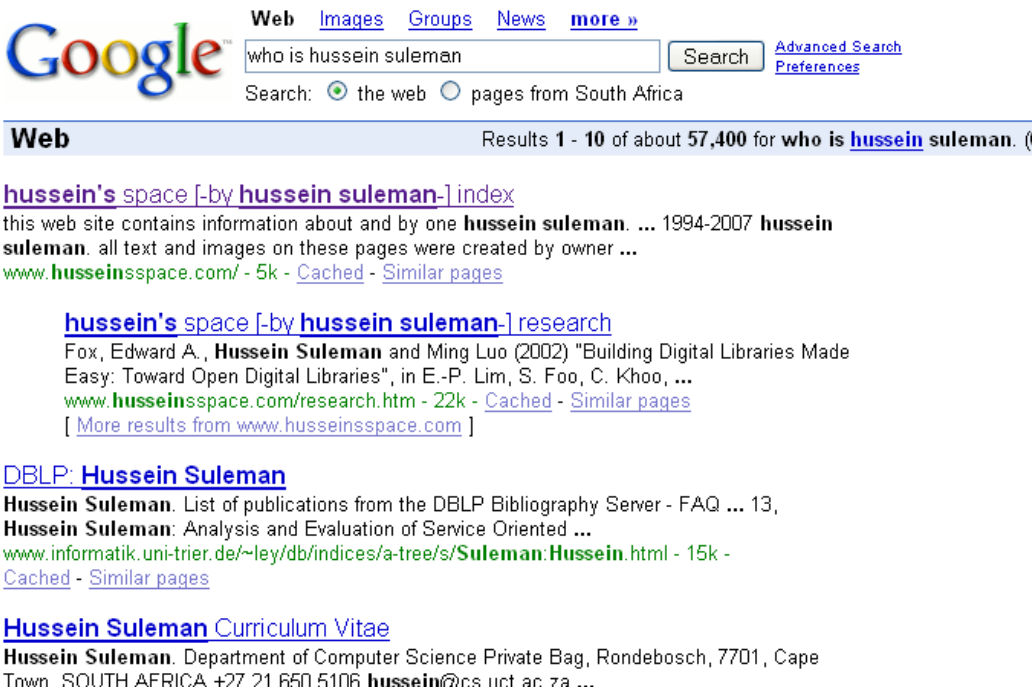
Why Computing is Important 2/5

- Computer Aided Tomography (CAT scans) are computer-reconstructed views of the internal organs that help in diagnosing patients.

Reference: Wikipedia

Why Computing is Important 3/5

- The world's information is available at our fingertips!



Why Computing is Important 4/5

- Games, Movies, MSN Messenger, Facebook …

Reference:
World of Warcraft,
The Burning Crusade,
Blizzard Entertinment

Why Computing is Important 5/5

- R1.8 billion was spent online in 2005 in South Africa just buying airline tickets!

Reference: Goldstuck Report, January 2006

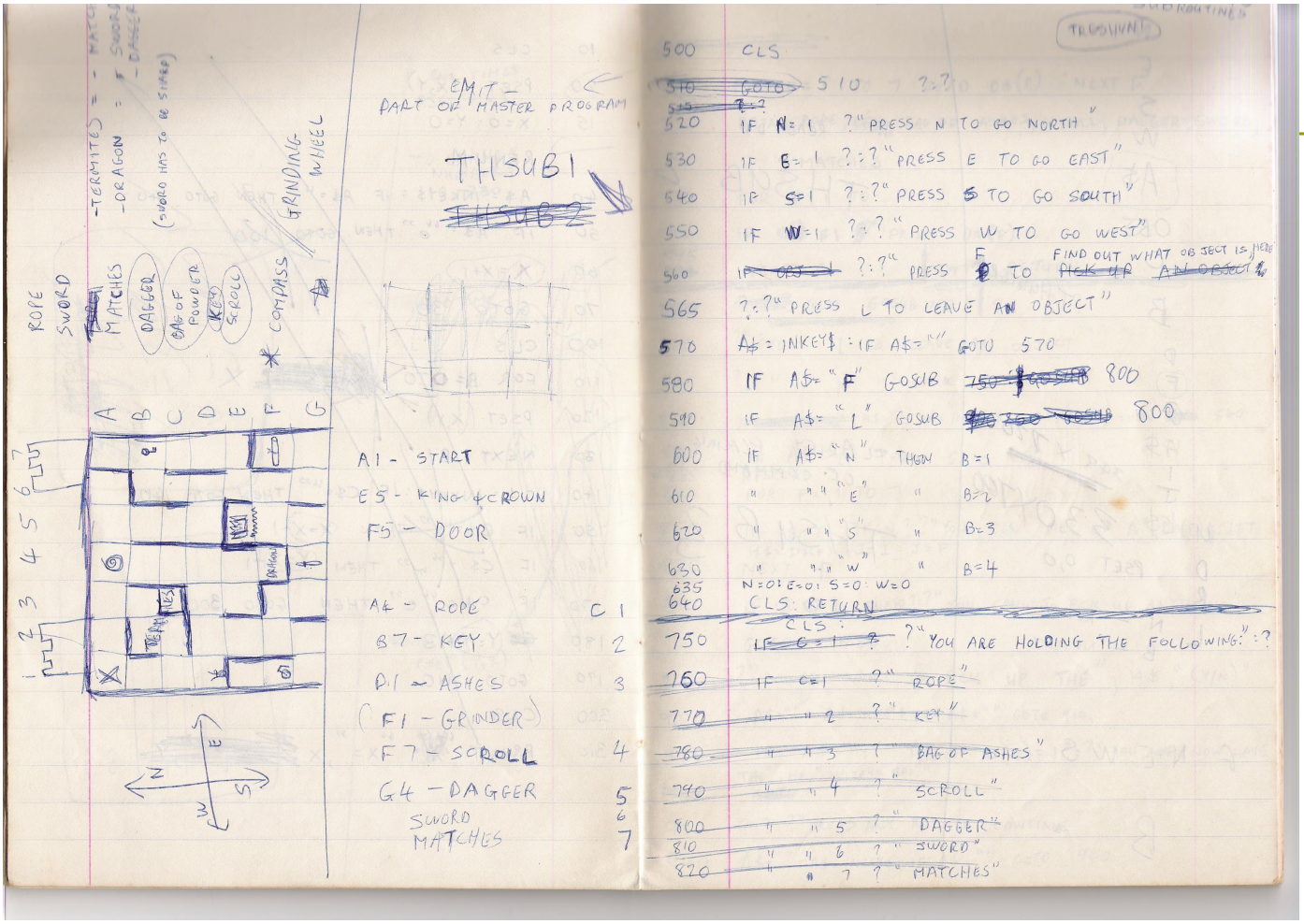
Areas in Computing @UCT

- Advanced Information Management
  - Databases, distributed computing
- Collaborative Visual Computing
  - Graphics, usability, virtual environments
- Data Network Architectures
  - Networking, software engineering
- Digital Libraries
  - Search engines, repositories, interoperability
- High Performance Computing
  - Scientific computing, cluster/grid computing
- Telecommunications
  - Traffic engineering, bandwidth management

What is Computer Science?

- Computer Science (CS) is the study of:
  - Computer software
  - Algorithms, abstractions and efficiency
  - Theoretical foundation for computation

- What you learn in Computer Science:
  - Principles of computation
  - How to make machines perform complex tasks
  - How to program a computer
  - What current technology exists and how to use it
  - Problem solving



Problem Solving in CS 1/2

1. Understand the problem
    1. What are the knowns and unknowns?
2. Plan how to solve the problem
    1. What algorithm is used to solve the problem?
    2. What assumptions are being made?
    3. Is this similar to other problems?
    4. Can the problem be split into parts?
3. Carry out your plan – write program
    1. Write program(s) to implement algorithm(s).

Problem Solving in CS 2/2

4. Assess the result
    1. Does the program conform to the algorithm?
    2. Does the program/algorithm solve the problem?
    3. Is the program correct for all cases?
5. Describe what you have learnt
    1. ... so you do not make the same mistakes again.
6. Document the solution
    1. Write a report for users of the program.
    2. Write comments within the program.

Reference: Vickers, P. 2008. How to think like a programmer. Cengage.

Algorithms

- An **algorithm** is a set of steps to accomplish a task.
- Everyday tasks require algorithms but we usually do not think about them.
  - E.g., putting on shoes, brushing teeth
- Algorithms must be precise so that they are
  - Repeatable
  - Have a predictable outcome
  - Can be executed by different people

Algorithm: Read a Novel

1. Acquire book
2. Fund comfortable spot to sit
3. Open book to set of facing pages
4. If there no more unread pages, go to step 8
5. Read facing pages
6. Turn page over
7. Go to step 4
8. Close book
9. Be happy

Elements of Algorithms

- Sequence
  - Each step is followed by another step
- Selection
  - A choice may be made among alternatives
- Iteration
  - A set of steps may be repeated

- Any language with these 3 constructs can express any classical algorithm.

Classic Problems / Algorithms

- Boil water in a kettle
- Take the minibus taxi to town
- Put on a pair of shoes
- Bake a cake
- Making a telephone call
- Buying a #1 Original Chicken Burger

Algorithm to Boil Water in Kettle

1. Take the lid off kettle
2. If there is enough water already, go to step 7
3. Put kettle under tap
4. Open tap
5. While kettle is not full,
   - Wait
6. Close tap
7. Replace lid on kettle
8. Plug kettle into power outlet
9. Turn kettle on
10. While water has not boiled,
    - Wait
11. Turn kettle off
12. Remove plug from power outlet

Algorithm: Take Minibus Taxi to Town

1. Make sure you have enough money
2. Wait at bus stop
3. Flag down taxi as it approaches
4. Get into taxi (somehow)
5. Collect fare from behind you, add your money and pass it forward
6. Shout at driver to stop
7. When taxi stops, prod other passengers to make them move out
8. Get out of taxi
9. Give thanks for a safe trip!

Programs

- A **program** is a set of instructions given to a computer, corresponding to an algorithm to solve a problem.
  - The act of writing a program is called **programming**.
- Programs are written in a precise language called a **programming language**.

- Sample Program (in Java):

```
class HelloWorld
{
   public static void main ( String [] args )
   {
      System.out.println ("Hello World");
   }
}
```


Process of Programming

- Programs work as follows:
  - Ingest information from the real world (**input**).
  - Process data internally.
  - Send computed data back to real world (**output**).

- Because of different input, each time a program executes the results can be different.

Java

- There are many different types of computer languages, and many different languages.
- This course is based on Java.
- Java is a general-purpose object-oriented programming language invented in the mid-90s by Sun Microsystems.

How We Program in Java

- We write **classes**.
- Each **class** is a template for the computer to create **objects** in memory – usually representations of some real-world concept.
- Ensure all classes know how to interact with other classes as is necessary.
- Execute the program by telling Java what the starting class is – Java then executes the **main** action/method from this class.
  - This first class/action can then create other objects and perform other actions.