User Interface Design

User Interface

- The interface is the part of the system that the user sees and interacts with.
  - User – the interface is the software
  - No good meeting all functional requirements if user is frustrated with the usability
- Interfaces should be designed for people:
  - Humans are not perfect
  - Maximise the user's efficiency, not just the system's efficiency
  - Meet user's real needs, not developer's assumptions

Usability

A vital software quality

- Usability measures the quality of a user's experience when interacting with a product or system www.usability.gov

- Ease of Use is often a stated requirement but how can it be measured effectively?
  - Usability is tested with real end users
    - Where a sample of typical users are measured performing a set of benchmark tasks
    - The software is being tested not the users
  - Choose appropriate measures
    - Qualitative measures are subjective
    - Quantitative measures offer better comparison

Usability
www.usability.gov

- Usability is a combination of factors including:
  - **Ease of learning** – How fast can new users learn to use the interface to accomplish basic tasks?
  - **Memorability** – Can new users remember enough to use it effectively the next time or do they need to start learning again?
  - **Efficiency of use** – Once experienced users have learned to use the system, how fast can they accomplish tasks?
  - **Error frequency and severity** – How often do users make errors while using the system, how serious are these errors, and how do users recover from these errors?
  - **Subjective satisfaction** – How much does the user *like* using the system?

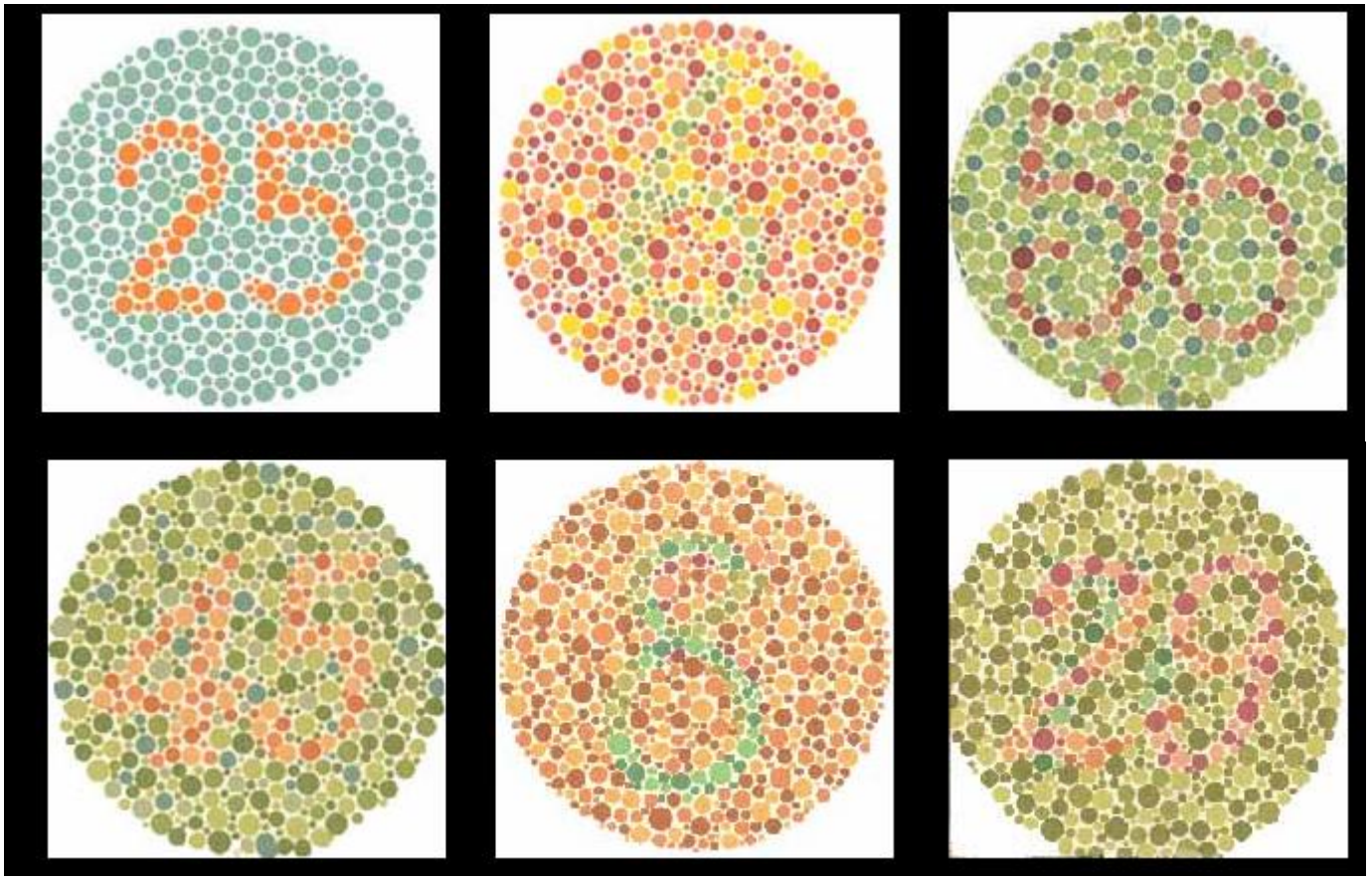
Ben Shneiderman's Principles and Guidelines of User Interface Design

- Principle 1: Recognise the Diversity
- Principle 2: Use the Eight Golden Rules
- Principle 3: Prevent Errors
- Guidelines for Data Display
- Guidelines for Data Entry

Principle 1 :
Recognise the Diversity – User Profiles

- Consider the range or different users that will use your system
  - age, disabilities, cultural differences, education, personality etc.
- Accessibility
  - E.g. For websites it is a legal requirement to comply with the disability discrimination act.
  - E.g. Colour Vision Deficiency – Red/Green deficiency most common – about 10% in males, less than 1% in females
- Experience of Users
  - Different types of users have different needs
  - Consider novice, intermittent, expert users

Principle 1: Recognise the Diversity
Ishihara Colour Vision Tests



Principle 1: Recognise the Diversity

- Task profiles
  - Analyse tasks: what are the most frequent tasks? most error-prone? slowest, fastest?
  - Decompose complex tasks
- Interaction Styles – The right style for the right user and task
  - Direct Manipulation –Provides a visual representation of tasks and objects that closely maps to the user's experience
  - Menu Systems –Users select from options presented by the system
  - Form fill-in – Users enter data in a set of related fields
  - Natural Language – User types a command in a natural language
  - Command Language –User types commands to give instructions to the system

Principle 2: Use the Eight Golden Rules

1. Strive for consistency
2. Shortcuts for frequent users
3. Offer informative feedback
4. Design dialogs to yield closure
5. Offer error prevention and simple error handling
6. Permit easy reversal of actions
7. Support internal locus of control
8. Reduce short-term memory load

- Consistent sequences of actions
- Terminology is similar throughout
- Consistency through layout, fonts and colours.

- Provide facilities for frequent users to increase pace of interaction

- Users require indication of feedback from each action.

- Informative feedback at end of a group of related actions gives sense of achievement
- Give indication of progress.

- Avoid opportunities to cause critical error (e.g. use widgets, input validation, etc.)
- Error messages should state problem clearly and offer help for recovery.

- Design actions to be reversible
- Allow users to undo actions that might have been mistake

- Rule of thumb: Keep max. 7+/- 2 pieces of information at once
- Do not expect users to remember information between screens.

- Users want to feel in control, otherwise they feel anxiety and dissatisfaction

Principle 3: Prevent Errors

- Minimise error messages by preventing errors in the first place
  - Correct matching pairs – includes parentheses, delimiters, tags
    - Where possible the editor should put open and closing markers on the screen to provide the template for entry
  - Complete sequences
    - Sequences are recognisable, frequent operations composed of simpler, more atomic operations
  - Correct commands
    - Select commands rather than type them – listboxes, radiobuttons etc
    - Anticipate commands by automatic command completion

Guidelines for Data Display (1)

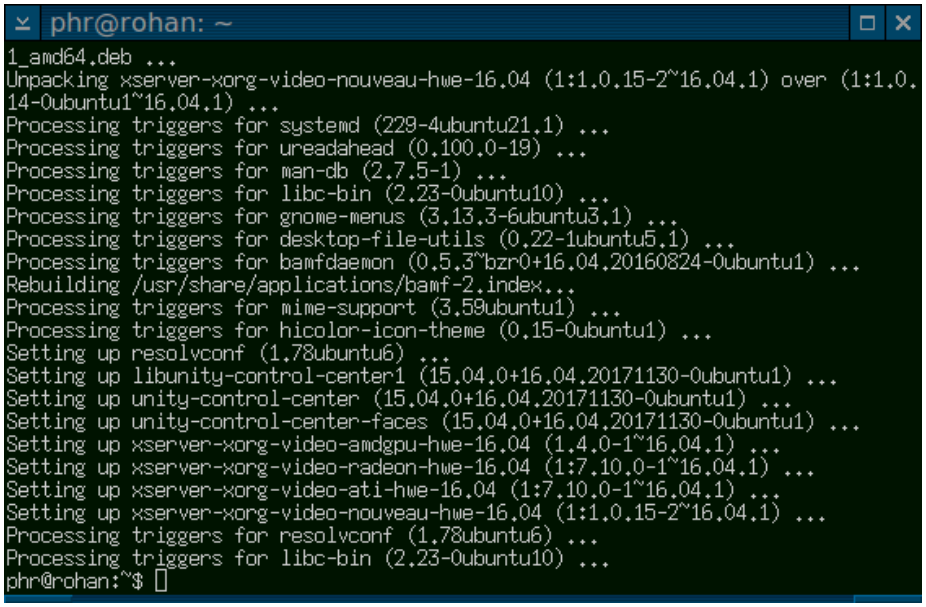
- Organising the Display
  - Consistency of data display between screens
  - Format should be familiar to user & related to the required task
  - Good layout of screens
  - Users should not need to remember information from one screen to another
  - Format of displayed (output) data linked to format of data entry
  - Flexibility for user to control of data display

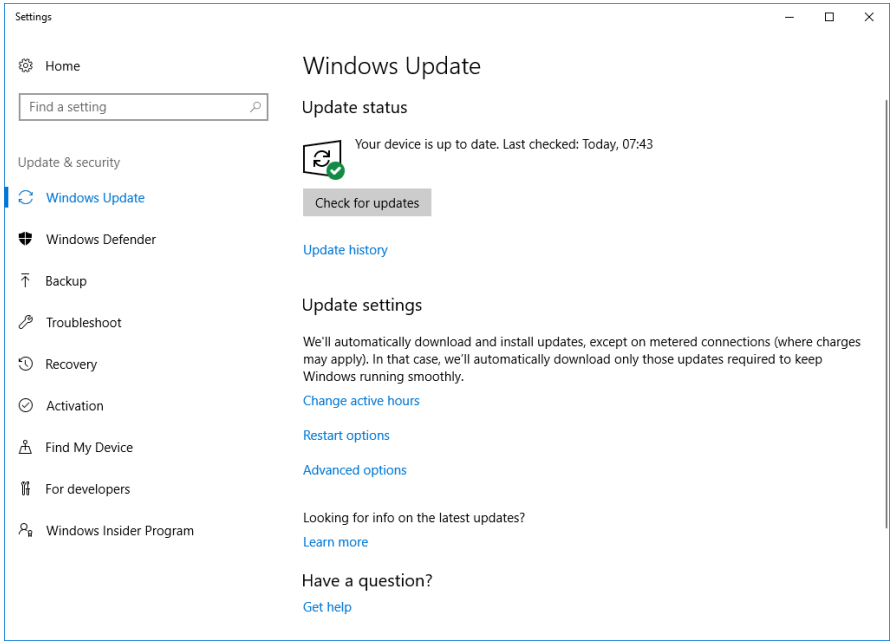
Guidelines for Data Display (2)

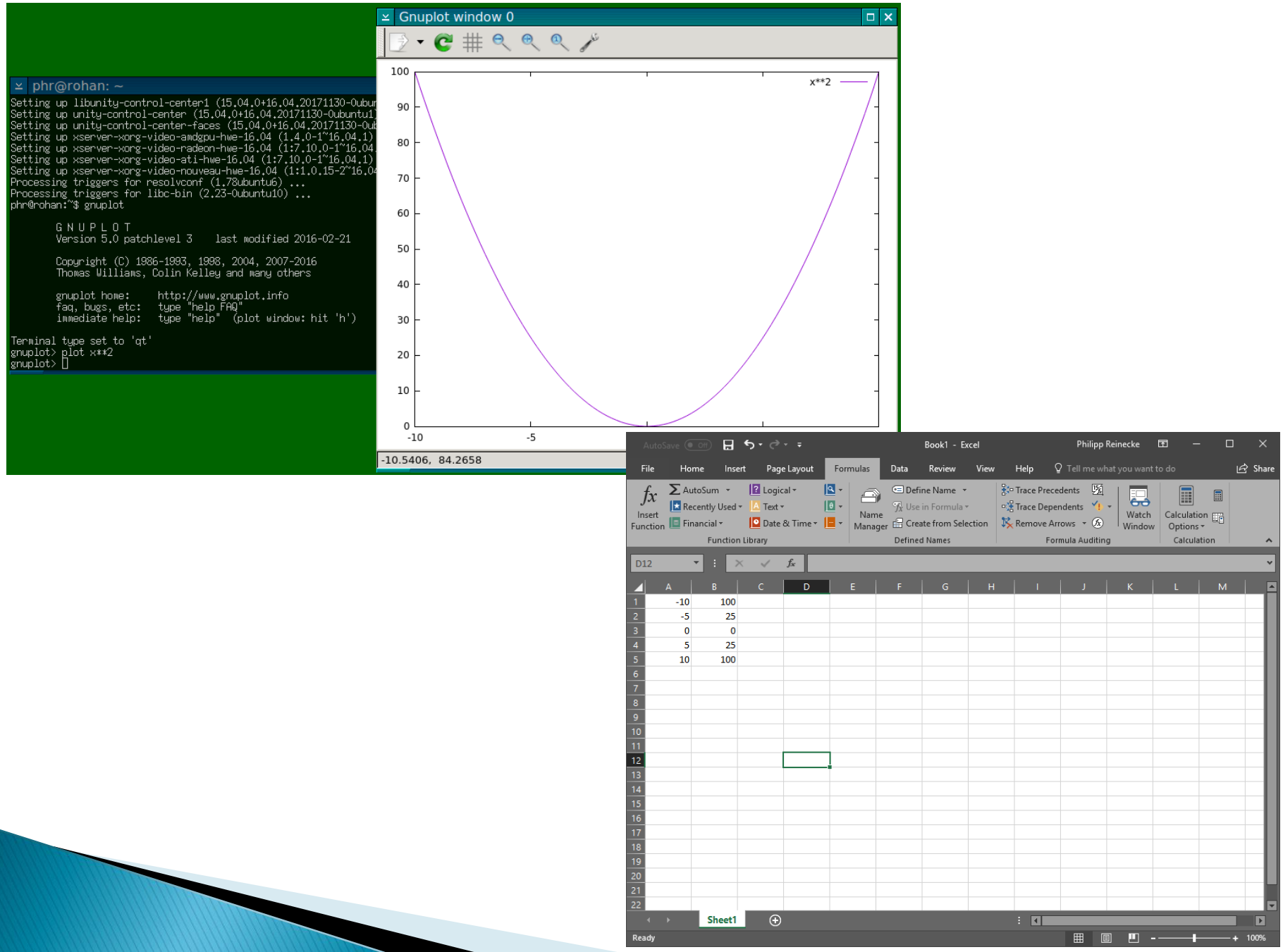
- Getting the user's attention
  - Intensity: two levels only – limit use of high intensity to draw attention
  - Marking: underline, enclose in a box, arrow, and indicators such as asterisk, bullet, dash, plus, or X
  - Size: up to four sizes
  - Font: up to three fonts
  - Inverse video: Use inverse colouring
  - Blinking: 2–4 HZ, with great care and limited areas
  - Colour: up to four standard colours – with additional colours for occasional use
  - Colour blinking: changes in colour used with great care in limited areas
  - Audio: Soft tones for positive feedback and harsh for rare emergency conditions

Guidelines for Data Entry

- Consistency of data entry transactions
- Minimal input actions by user
  - Choose appropriate controls for data input to reduce time for entry and minimise input errors
  - Redundant data entry should be avoided
- Minimal memory load
  - Users should not need to remember lengthy lists of codes, action sequences or complex command strings
- Compatibility of data entry with data display
- Flexibility for user control of data entry
  - Given to experienced users who may want to enter information in a sequence they can control


phr@rohan: ~
1_amd64.deb ...
Unpacking xserver-xorg-video-nouveau-hwe-16.04 (1:1.0.15-2~16.04.1) over (1:1.0.
14-0ubuntu1~16.04.1) ...
Processing triggers for systemd (229-4ubuntu21.1) ...
Processing triggers for ureadahead (0.100.0-19) ...
Processing triggers for man-db (2.7.5-1) ...
Processing triggers for libc-bin (2.23-0ubuntu10) ...
Processing triggers for gnome-menus (3.13.3-6ubuntu3.1) ...
Processing triggers for desktop-file-utils (0.22-1ubuntu5.1) ...
Processing triggers for bamfdaemon (0.5.3~bzr0+16.04.20160824-0ubuntu1) ...
Rebuilding /usr/share/applications/bamf-2.index...
Processing triggers for mime-support (3.59ubuntu1) ...
Processing triggers for hicolor-icon-theme (0.15-0ubuntu1) ...
Setting up resolvconf (1.78ubuntu6) ...
Setting up libunity-control-center1 (15.04.0+16.04.20171130-0ubuntu1) ...
Setting up unity-control-center (15.04.0+16.04.20171130-0ubuntu1) ...
Setting up unity-control-center-faces (15.04.0+16.04.20171130-0ubuntu1) ...
Setting up xserver-xorg-video-amdgpu-hwe-16.04 (1.4.0-1~16.04.1) ...
Setting up xserver-xorg-video-radeon-hwe-16.04 (1:7.10.0-1~16.04.1) ...
Setting up xserver-xorg-video-ati-hwe-16.04 (1:7.10.0-1~16.04.1) ...
Setting up xserver-xorg-video-nouveau-hwe-16.04 (1:1.0.15-2~16.04.1) ...
Processing triggers for resolvconf (1.78ubuntu6) ...
Processing triggers for libc-bin (2.23-0ubuntu10) ...
phr@rohan:~$


Settings
Home
Find a setting
Update & security
Windows Update
Windows Defender
Backup
Troubleshoot
Recovery
Activation
Find My Device
For developers
Windows Insider Program
Windows Update
Update status
Your device is up to date. Last checked: Today, 07:43
Check for updates
Update history
Update settings
We'll automatically download and install updates, except on metered connections (where charges may apply). In that case, we'll automatically download only those updates required to keep Windows running smoothly.
Change active hours
Restart options
Advanced options
Looking for info on the latest updates?
Learn more
Have a question?
Get help


phr@rohan: ~
Setting up libunity-control-center1 (15.04.0+16.04.20171130-0ubu
Setting up unity-control-center (15.04.0+16.04.20171130-0ubuntu1
Setting up unity-control-center-faces (15.04.0+16.04.20171130-0u
Setting up xserver-xorg-video-amdgpu-hwe-16.04 (1.4.0-1~16.04.1)
Setting up xserver-xorg-video-radeon-hwe-16.04 (1:7.10.0-1~16.04
Setting up xserver-xorg-video-ati-hwe-16.04 (1:7.10.0-1~16.04.1)
Setting up xserver-xorg-video-nouveau-hwe-16.04 (1:1.0.15-2~16.0
Processing triggers for resolvconf (1.78ubuntu6) ...
Processing triggers for libc-bin (2.23-0ubuntu10) ...
phr@rohan:~$ gnuplot
G N U P L O T
Version 5.0 patchlevel 3 last modified 2016-02-21
Copyright (C) 1986-1993, 1998, 2004, 2007-2016
Thomas Williams, Colin Kelley and many others
gnuplot home: http://www.gnuplot.info
faq, bugs, etc: type "help FAQ"
immediate help: type "help" (plot window: hit 'h')
Terminal type set to 'qt'
gnuplot> plot x**2
gnuplot>
Gnuplot window 0
x**2
100
90
80
70
60
50
40
30
20
10
0
-10
-5
-10.5406, 84.2658
Book1 - Excel
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Formulas
Data
Review
View
Help
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Share
Insert Function
AutoSum
Recently Used
Financial
Logical
Text
Date & Time
Function Library
Name Manager
Define Name
Use in Formula
Create from Selection
Defined Names
Trace Precedents
Trace Dependents
Remove Arrows
Formula Auditing
Watch Window
Calculation Options
Calculation
D12
A B C D E F G H I J K L M
1 -10 100
2 -5 25
3 0 0
4 5 25
5 10 100
Sheet1
Ready
100%

References

Ben Shneiderman *"Designing the User Interface – Strategies for effective Human-Computer Interaction"* Addison-Wesley