

# Computer Driven Tutorials

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# Computer Driven Tutorials

## Introduction

- Computer Driven Tutorials (CDTs) used to supplement or replace weekly assignments in first year engineering
- Human Scaffolding
  - Human → interactivity between TAs and students
  - Scaffolding → structured approach
- More effective tutorials = more successful students
- **Maple TA** web-based system



# Computer Driven Tutorials

## Introduction

### Question 1: (3 points)

Choose the correct output for the following program.

```
class A
{
    public:
        double d;
        int i;
        A():d(0.0),i(1){}
        A(double D,int I):d(double(D)),i(int(I)){}
};
class B
{
    public:
        A a;
        B():a(A(3.1,2)){}
        B(A &a):a(&a){}
};
int main()
{
    int i=3;
    double d=4.1;
    cout<<B(A(d,i)).a.d<<" "
        <<B(A(d,i)).a.i<<" "
        <<B().a.d<<" "
        <<B().a.i<<" "
        <<B(&()).a.d<<" "
        <<B(&()).a.i<<"\n\n";
    system("PAUSE");
    return(0);
}
```

- 4 3 3 2 1 0
- none of the others
- 4.1 3 3 1 2 1 0
- 3 4 2 3 0 1
- 3 4.1 2 3 1 0 1

### Question 2: (1 point)

For class Triangle, write the header for the draw function. Use const where required (It is NOT required when passing a built-in type such as int or double). Do NOT include dummy variable names in the parameter list...variable types ONLY.

```
#include "ccc_win.h"
#include "strvalue.cpp"

class Triangle
{
    public:

    private:
        Point A,B,C;
};

int ccc_win_main()
{
    Triangle T1,T2(Point(3,4),Point(-8,9),Point(5,-7));
    T2.draw();
    cwin<<T2.centroid()
        <<Message(Point(-8,-8),"Area of T2 = "+stringvalue(T2.area|),4);
    T1=T2.rotate(60);
    T1.draw();
    return(0);
}
```

# Computer Driven Tutorials

Introduction • Measuring Success

- Success: student is promoted to next term
- Promotion is based solely on final term grades
- Factors influencing a student's grades
  1. Talent / Intelligence
  2. Effort
  3. Background knowledge
  4. Workload
  5. Adverse circumstances (personal issues)
  6. Accuracy of evaluations

# Computer Driven Tutorials

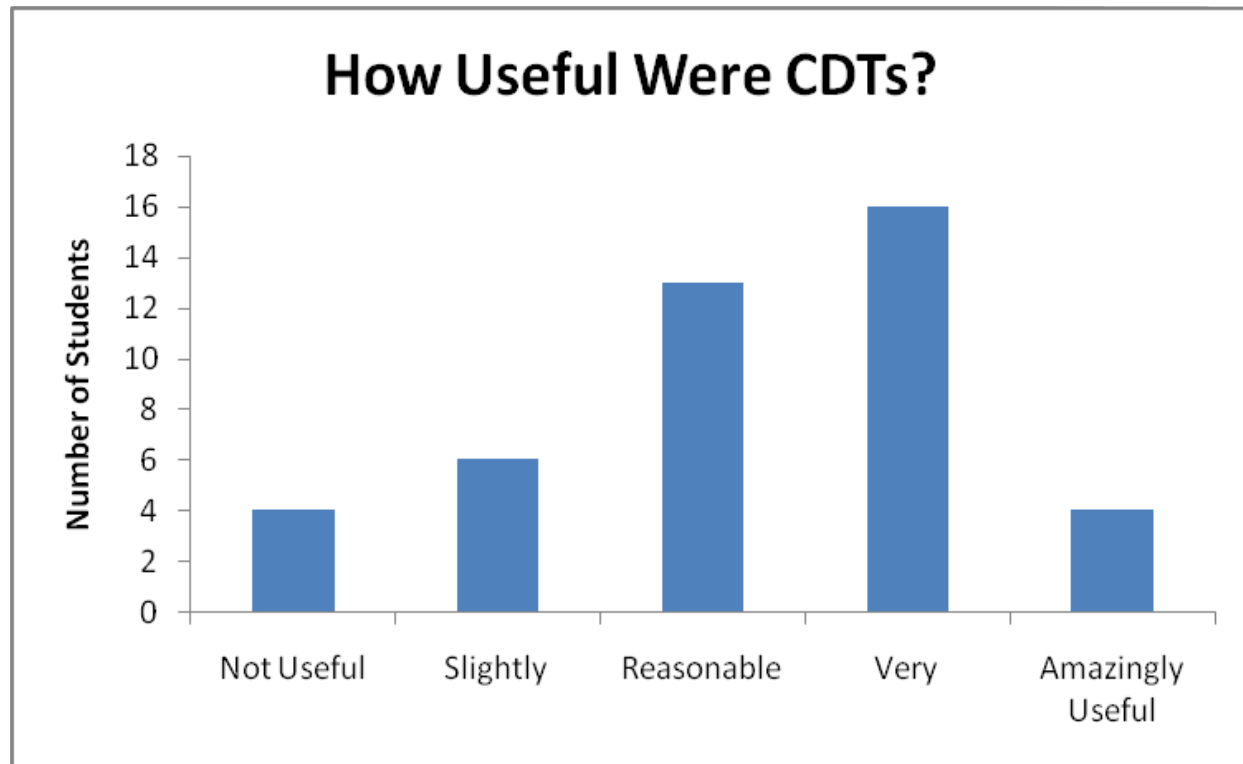
Introduction • Measuring Success

- Three areas of interest to measure CDT effectiveness
  1. Grades
  2. Interactivity
  3. Technical Problems
- Survey for students in GE121 (C++) and GE123 (circuits)
- Instructor interviews

# Computer Driven Tutorials

Introduction • Measuring Success • Results

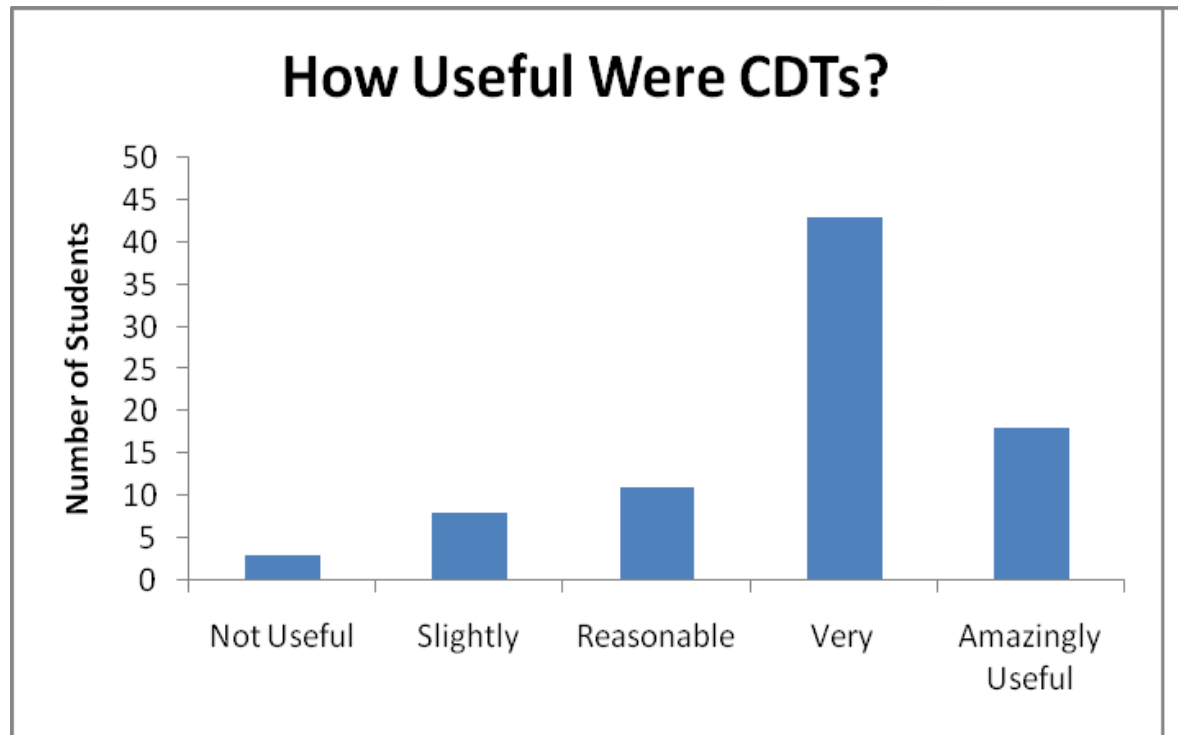
## C++ Programming



# Computer Driven Tutorials

Introduction • Measuring Success • Results

## Circuits

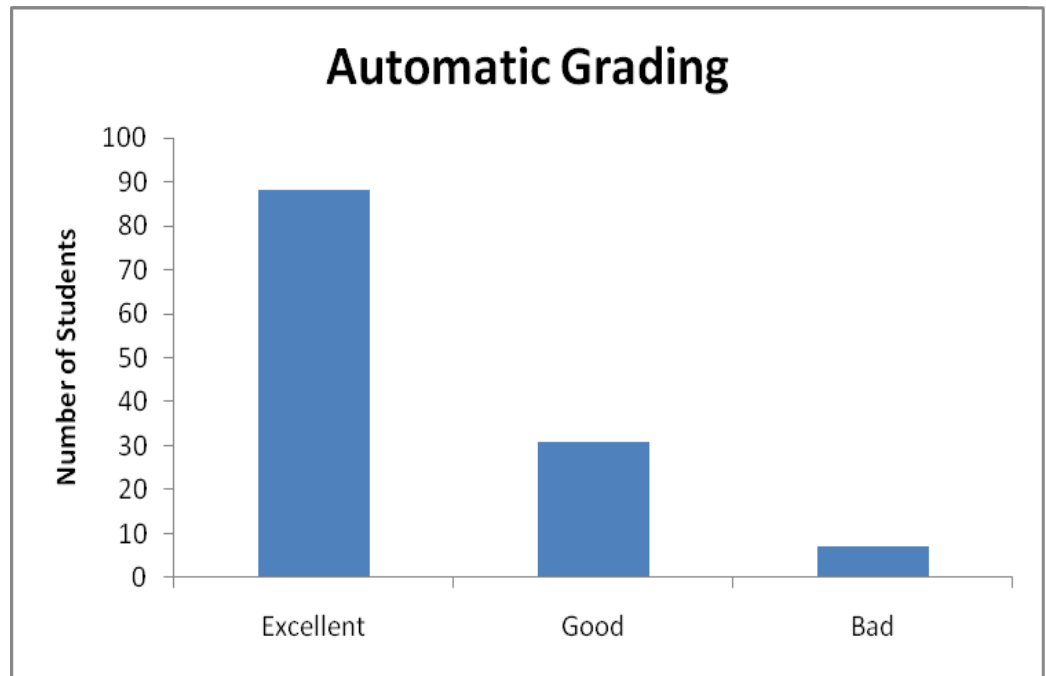


# Computer Driven Tutorials

Introduction • Measuring Success • Results

## Technical Problems

- Some compatibility problems
- Automatic grading too specific
- Slowness / freezing during timed CDTs





# Computer Driven Tutorials

Introduction • Measuring Success • Results

## Instructor Observations

- Attendance was excellent
- Maple TA is difficult to use in some areas, takes students some time to adjust to the interface
- Works well for formula type questions
  - randomly generate, require specific numeric answers
- Students can use trial and error to avoid learning 😞
- No feedback on written solution style!
- CDTs take time away from other assignments

# Computer Driven Tutorials

Introduction • Measuring Success • Results • Analysis

Some Math...

$$\rho = \frac{\text{cov}(X,Y)}{s_x s_y}, \quad s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}, \quad \text{cov}(X,Y) = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{n-1}$$

- Correlation ( $\rho$ ) measures linear relationship
- Excel™ does it for us 😊
- Is there a linear relationship between CDT usage and student performance?

Variates (X,Y)	C++	Electrical
CDT usage, Final grade	0.17	0.33
CDT usage, Midterm exam grade		
CDT usage, Final exam grade	<b>NO</b>	<b>???</b>
CDT usage, Average lab grade	0.04	0.39
CDT useful?, final grade	0.10	0.27

# Computer Driven Tutorials

Introduction • Measuring Success • Results • Analysis

## Sources of Error

- Circuits CDTs replaced weekly assignments
  - bad usage statistics
- 1B students were studied, maybe useful for 1A?
- Study was voluntary, no remuneration
  - survey respondents non-random

Indicator	C++	Electrical
Mean	73	75
Standard Deviation	14.53	17.98
Minimum Mark	31	35
Maximum Mark	98	100

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## Conclusions

- Students like CDTs, especially for circuits
- Students feel overwhelmed, CDTs add to the workload
- CDTs are a workable method for assignment delivery
- If existing methods work well, don't replace with CDTs

## Recommendations

- Improve system stability, compatibility and speed
- Improve CDT design → feedback, auto-grading

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Questions?