

INFOGR – Computer Graphics

Jacco Bikker & Debabrata Panja - April-July 2018

Lecture 1: “Introduction”

Welcome!



Today's Agenda:

- Graphics
- Course Introduction
- Math 1



Introduction

```
ics
& (depth < MAXDEPTH)
{
    if (inside ? 1 : 0)
    {
        nt = nt / nc; ddn = ddn * ddn;
        cos2t = 1.0f - nnt * ddn;
        D, N );
    }
    at a = nt - nc, b = nt;
    at Tr = 1 - (R0 + (1 - R0) * a);
    R = (D * nnt - N * a);
    E * diffuse;
    = true;
    refl + refr)) && (depth
    D, N );
    refl * E * diffuse;
    = true;
    MAXDEPTH)
    survive = SurvivalProbab
    estimation - doing it
    df;
    radiance = SampleLight(
    e.x + radiance.y + radi
    w = true;
    at brdfPdf = EvaluateDi
    at3 factor = diffuse *
    at weight = Mis2( direc
    at cosThetaOut = dot( N
    E * ((weight * cosThet
    random walk - done properly, closely following
    (survive)
    ;
    at3 brdf = SampleDiffuse( diffuse, N, r1, r2, &R, &pdf );
    survive;
    pdf;
    n = E * brdf * (dot( N, R ) / pdf);
    sion = true;
```



Introduction

```
ics
& (depth < MAXDEPTH)
{
    if (inside ? 1 : 0.25)
    {
        nt = nt / nc; ddn = dot(
        os2t = 1.0f - nnt * nnt;
        D, N );
        0);
    }
    at a = nt - nc, b = nt;
    at Tr = 1 - (R0 + (1 -
    Tr) R = (D * nnt - N *
    E * diffuse;
    = true;
    -
    efl + refr)) && (depth
    D, N );
    refl * E * diffuse;
    = true;
    MAXDEPTH)
    survive = SurvivalProba
    estimation - doing it
    df;
    radiance = SampleLight(
    e.x + radiance.y + radi
    w = true;
    at brdfPdf = EvaluateDi
    at3 factor = diffuse *
    at weight = Mis2( direc
    at cosThetaOut = dot( N
    E * ((weight * cosThet
    random walk - done properly, closely following Survival
    ve)
```



Introduction

```

ics
& (depth < MAXDEPTH)
{
    if (inside ? 1 : 0)
    {
        nt = nt / nc; ddn = dot(
        cos2t = 1.0f - nnt * pi
        D, N );
        )
        {
            at a = nt - nc, b = nt
            at Tr = 1 - (R0 + (1 -
            Tr) R = (D * nnt - N *
            )
            E * diffuse;
            = true;
            -
            refl + refr)) && (depth
            D, N );
            refl * E * diffuse;
            = true;
            MAXDEPTH)
            survive = SurvivalProba
            estimation - doing it
            df;
            radiance = SampleLight(
            e.x + radiance.y + radi
            w = true;
            at brdfPdf = EvaluateDi
            at3 factor = diffuse *
            at weight = Mis2( direc
            at cosThetaOut = dot( N
            E * ((weight * cosThet

```



```

random walk - done properly, closely following
ive)

```

```

;
at3 brdf = SampleDiffuse( diffuse, N, r1, r2, &R, &pdf );
survive;
pdf;
n = E * brdf * (dot( N, R ) / pdf);
sion = true;

```



Introduction

Computer Graphics 2018:

Looking for realism (in several wrong places):

1. Rasterization

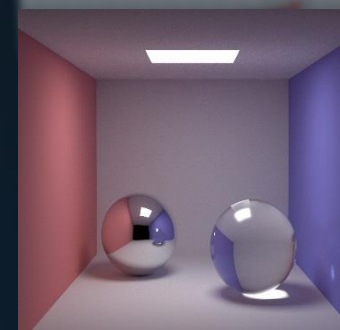
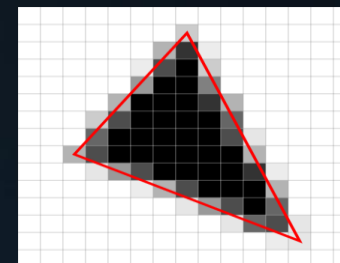
- Geometry
- Textures, shaders
- Clipping, culling
- Post processing
- ...

2. Ray tracing

- Ray/triangle intersections
- Bounding volume hierarchy
- Snell, Fresnel, Beer
- Whitted, Cook, Kajiya
- ...

3. Mathematics

- Vectors
- Matrices
- Transformations



Introduction

Language: English,
because of reasons.

Prerequisites: C#.

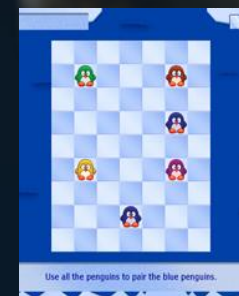
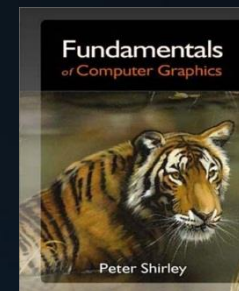
Literature: Fundamentals of Computer Graphics (3rd edition), by
Peter Shirley and Steve Marschner (or 4th, or 2nd, or 1st).

~15 lectures.

Supporting math tutorials and working lectures.

For rooms: see schedule.

NEW: Respect the ‘groepsindeling’.



Introduction

Exams:

- Mid-term: May 16th.
- End of term: June 27th.
- Retake: July 11th.

Attendance:

You are not required to attend any of the lectures / tutorials / practicals (i.e., if you are here, it's because you want to).*

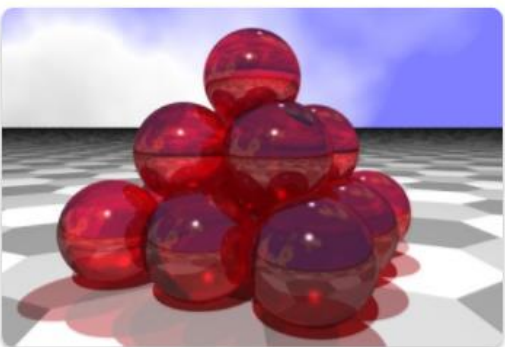
*Obviously, attendance is highly recommended.



Graphics

UNIVERSITEIT UTRECHT - INFORMATION AND COMPUTING SCIENCES

academic year 2017/18 – 4th period



Navigation

<http://www.cs.uu.nl/docs/vakken/gr>

News

Resources (lectures, slides)

Practicals

Exam & Grading

Course Overview

Schedule

Practica

Literature & Links

News



Ctrl+1



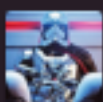
Ctrl+2



Ctrl+3



Ctrl+4



Ctrl+5



INFOGR2018 ▾



● Jacco Bikker

All Threads

Channels



general

random

🔒 supervisors

Direct Messages



♥ slackbot

● Jacco Bikker (you)

● Bereket

○ Ik houd van frikandellen

○ Jeffrey

+ Invite People

Apps



#general

☆ | 👤 4 | 🔔 0 | Company-wide announcements and work-based matters



🔍 Search

<https://infogr2018.slack.com/signup>

use student.uu.nl e-mail address

general

You created this channel today. This is the very beginning of the #general channel. It is for workspace-wide communication and announcements. All members are in this channel.

[+ Add an app](#) [👤 Invite others to this channel](#)

Today

**Jacco Bikker** 10:55 AM

joined #general along with 3 others.



Message #general

Introduction

```
ics
& (depth < MAXDEPTH)
{
    if (inside ? 1 : 0.25)
    {
        nt = nt / nc; ddn = ddn * ddn;
        ps2t = 1.0f - nnt * ddn;
        D, N );
    }
    else
    {
        at a = nt - nc, b = nt + nc;
        at Tr = 1 - (R0 + (1 - R0) * ddn);
        Tr) R = (D * nnt - N * (ddn > 0.5));
    }
    E * diffuse;
    = true;
    -
    refl + refr)) && (depth < MAXDEPTH)
    {
        D, N );
        -refl * E * diffuse;
        = true;
    }
}

MAXDEPTH)

survive = SurvivalProbability( diffuse, L, N );
estimation - doing it properly, closely following
if;
radiance = SampleLight( &rand, I, &L, &lightPdf,
e.x + radiance.y + radiance.z) > 0) && (depth <
{
    w = true;
    at brdfPdf = EvaluateDiffuse( L, N ) * Psurvive;
    at3 factor = diffuse * INVPI;
    at weight = Mis2( directPdf, brdfPdf );
    at cosThetaOut = dot( N, L );
    E * ((weight * cosThetaOut) / directPdf) * (radiance
    random walk - done properly, closely following Small's
    vive)
};
at3 brdf = SampleDiffuse( diffuse, N, r1, r2, &R, &pdf );
survive;
pdf;
n = E * brdf * (dot( N, R ) / pdf);
sion = true;
```

Course characteristics:

This is a very intensive course. Be sure to keep up, i.e. don't miss lectures.

Be aware that this course will be attended by a diverse student population:

- Math-savvy students;
- Programming gurus;
- Game people;
- Informatics guys.

Regardless of your skill level and interests, make use of this course to improve.



Team

Lecturers:

Jacco Bikker

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Debabrata Panja

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Office: BBL 511



Team

Student Assistants:

1. Frederico D'Ambrosio
2. Mark Dekker
3. Jan Posthoorn
4. Willem Wijnia
5. Iwan Bokseveld
6. Niels Kwadijk
7. Hugo Peters



Practical Details

```
ics
& (depth < MAXDEPTH)
{
    if (inside ? 1 : 0)
    {
        nt = nt / nc; ddn = ddn * ddn;
        cos2t = 1.0f - nnt * ddn;
        D, N );
    }
    else
    {
        at a = nt - nc, b = nt + nc;
        at Tr = 1 - (R0 + (1 - R0) *
        Tr) R = (D * nnt - N * (ddn
    }

    E * diffuse;
    = true;

    -
    refl + refr)) && (depth < MAXDEPTH)
    {
        D, N );
        refl * E * diffuse;
        = true;

    }
}

MAXDEPTH)

survive = SurvivalProbability( diffuse,
estimation - doing it properly, closely following
if;
radiance = SampleLight( &rand, I, &L, &light;
e.x + radiance.y + radiance.z) > 0) && (depth <
w = true;
at brdfPdf = EvaluateDiffuse( L, N ) * Psurvive;
at3 factor = diffuse * INVPI;
at weight = Mis2( directPdf, brdfPdf );
at cosThetaOut = dot( N, L );
E * ((weight * cosThetaOut) / directPdf) * (radiance
random walk - done properly, closely following Smallwood
vive)

;
at3 brdf = SampleDiffuse( diffuse, N, r1, r2, &R, &pdf );
survive;
pdf;
n = E * brdf * (dot( N, R ) / pdf);
sion = true;
```

Assignment Overview:

- P1: “Introduction”;
- P2: Ray Tracing;
- P3: Rasterization.

Final practicum grade is $(P1 + 2 P2 + 2 P3) / 5$.

Exam overview:

- T1: Mid-term exam;
- T2: Final exam.

Final exam grade is $0.3 * T1 + 0.7 * T2$.

Final grade: $(T + P) / 2$

Passing criteria:

Final Grade ≥ 6 (after rounding); both T and P ≥ 5.0 (before rounding).



Practical Details

How to hand in assignments:

- <http://www.cs.uu.nl/docs/submit>

First assignment (“Introduction”) is online now:
See website.

```
ics
& (depth < MAXDEPTH) {
    // Inside?
    if (inside ? 1 : 1.25 * nnt) {
        nt = nt / nc, ddn = ddn * nc;
        pos2t = 1.0f - nnt * ddn;
        D, N );
    }
    // Outside?
    if (a = nt - nc, b = nt * nc, c = nt * nc) {
        // Tr = 1 - (R0 + (1 - R0) * ddn)
        // Tr = (D * nnt - N * (ddn * nnt))
        // E * diffuse;
        // = true;
        //
        // refl + refr)) && (depth < MAXDEPTH) {
        // D, N );
        // refl * E * diffuse;
        // = true;
        //
        // MAXDEPTH)
        // survive = SurvivalProbability( diffuse );
        // estimation - doing it properly, closely following Small's
        // if;
        // radiance = SampleLight( &rand, I, &L, &lightPdf );
        // e.x + radiance.y + radiance.z) > 0) && (depth < MAXDEPTH) {
        // w = true;
        // at brdfPdf = EvaluateDiffuse( L, N ) * Psurvive;
        // at3 factor = diffuse * INVPI;
        // at weight = Mis2( directPdf, brdfPdf );
        // at cosThetaOut = dot( N, L );
        // E * ((weight * cosThetaOut) / directPdf) * (radiance.x + radiance.y + radiance.z);
        // random walk - done properly, closely following Small's
        // vive)
        //
        // at3 brdf = SampleDiffuse( diffuse, N, r1, r2, &R, &pdf );
        // survive;
        // pdf;
        // n = E * brdf * (dot( N, R ) / pdf);
        // ion = true;
```



Practical Details

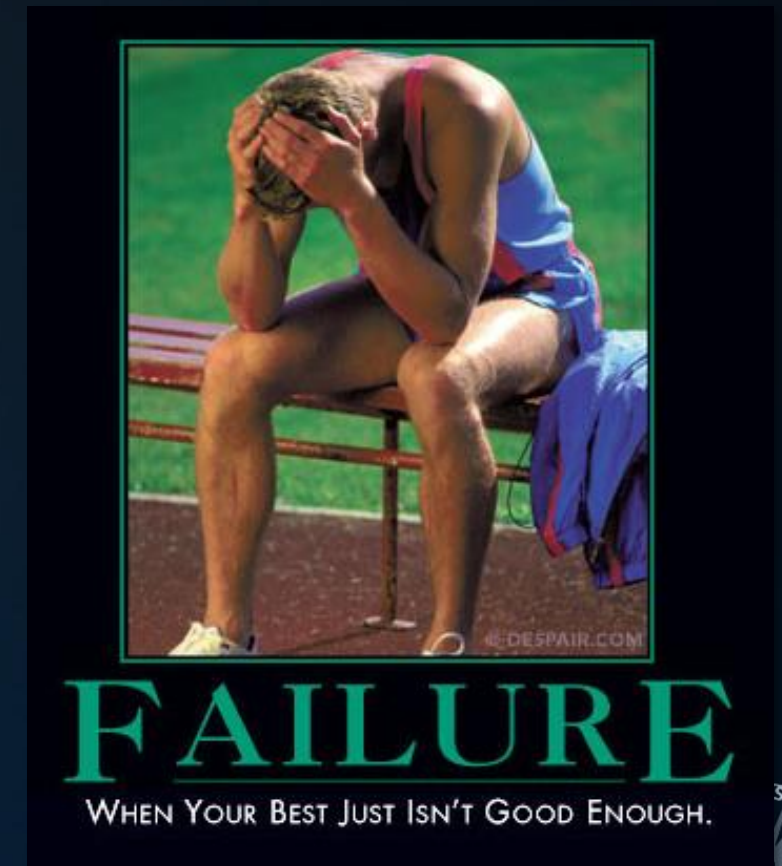
Retake: only if you failed the course, and scored at least a 4.0 (before rounding).

Retake / Theory:

- Retake covers all theory and replaces $\min(T1, T2)$.

Retake / Practical:

- Retake replaces $\min(P2, P3)$.
Topic will be assigned individually.



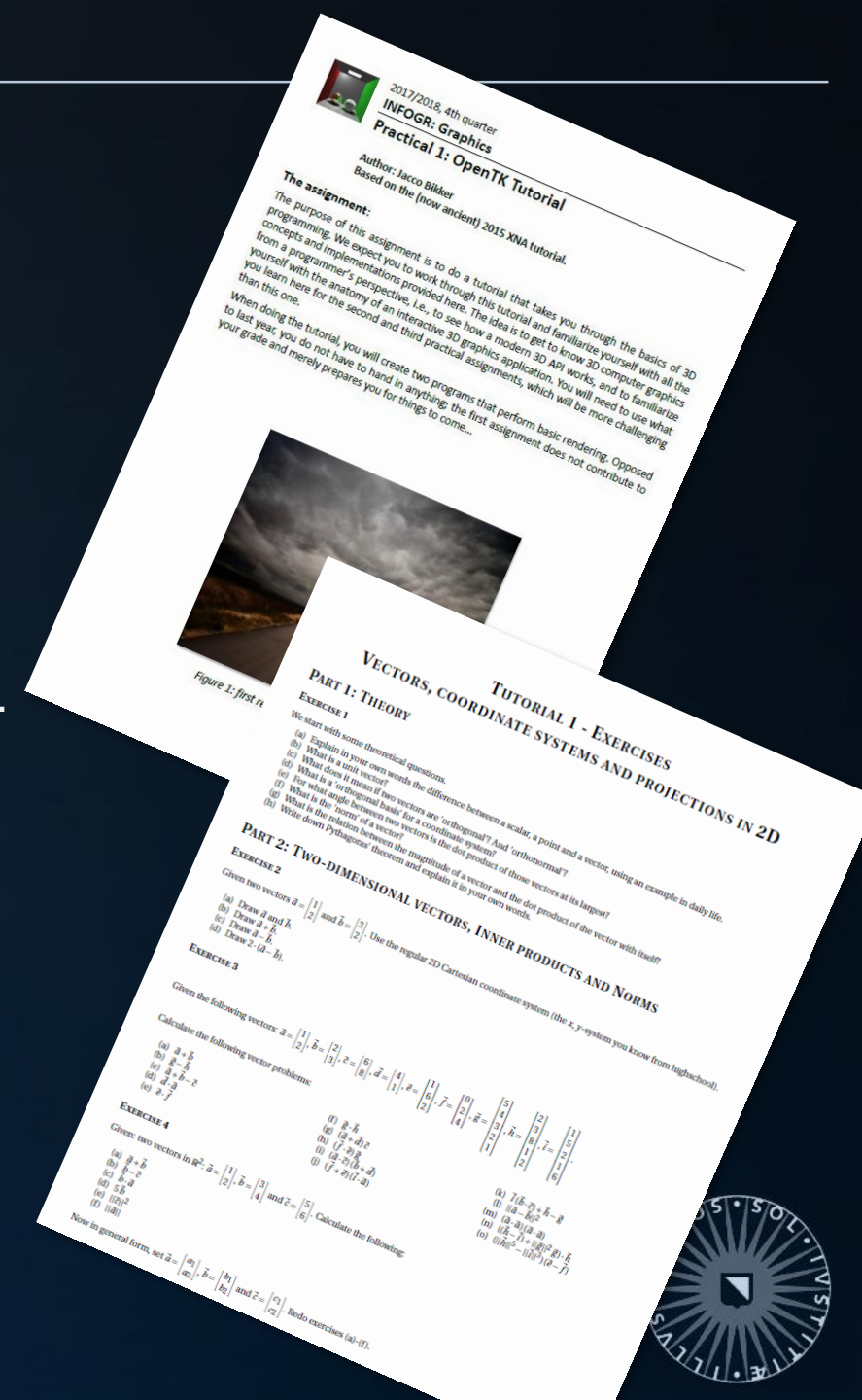
Assignments

PART 1: Mathematics

Tutorial 1 is now available from the website.

PART 2: Programming assignment

P1 (OpenTK Introduction) is now available from the website.
Assistance is available after each lecture.



Today's Agenda:

- Graphics
- Course Introduction
- Math 1

