Major Programs

Students seeking the B.S. or the B.A. degree with a major in science are expected to elect their majors at the beginning of Sophomore year, although a major in science may still be elected later if the student has completed the courses required to enter it. Sophomores interested in majoring in science should have their schedules approved by the Director of Undergraduate Studies or adviser designated by the department in which they wish to major. Students seeking the B.A. degree with a major in science are expected to elect their major at the beginning of Junior year. The schedules for Sophomore year of these students must be signed by the Sophomore adviser, chosen by the student, with whom the program has been discussed.

All candidates for a bachelor's degree in Yale College must elect one of the major programs listed on page 28. The requirements for a major are described in general terms in the sections below, and in more detail at the beginning of the course descriptions of each department or program. In Chapter III. Professorial advisers must be selected for these students in consultation with a representative of the department or program concerned, and must secure the consultant's written approval. Students should acquaint themselves fully with all the requirements of the major they plan to enter, considering not only the immediate choice of courses but also the plan of their entire work in the last two or three years in college.

Selection of a Major

In designing a program of study, the student ought to plan for both concentration as well as breadth of scope. To study a subject in depth can be one of the most rewarding and liberating experiences a person can secure and can form the basis of interests and occupations of a lifetime. Although no one should specialize to the neglect of distribution, knowledge advances by specialization, and one can gain some of the excitement of discovery by pressing toward the outer limits of human knowledge in particular fields. Intense study of a seemingly narrow area of investigation will often disclose ramifications and connections that alter perspectives on every other subject. Such study also sharpens a person's judgment and acquaints him with processes by which new truths can be found.

In order to expose themselves to this kind of experience, students must choose a field of study that will be their major field, that is, the subject in which they will work more intensively than they do in any other. A list of possible majors in Yale College from which such a choice is to be made is given below on page 28. Specific requirements for each major are established by the department or program concerned and are explained in Chapter III.

Some students will have made a tentative choice of a major before entering college. Others will have settled on a general area—for example, sciences or the humanities—without being certain of the particular program or program they intend to major in. Still others will be undecided. Past experience shows that students who arrive with a preliminary exploration of the subjects to which they are drawn, in order to become aware of their own tastes, talents, and interests, and to gain flexibility, often make the best choice of programs. In any event, students should have the opportunity to select a major from the full range of options available to them after the first two years of college, and the opportunity to change their major should keep open the possibility of a flexible course of study. For example, in the upperclass years, each student should think seriously about the choice of a major before arriving at college. A student who shows interest in majoring in a science should be sure to include the freshman year a course in mathematics and probably two or three introductory courses in each of the major fields that are major fields in chemistry. Students who cannot comfortably assimilate the knowledge of a foreign language would be well advised to take during freshman year courses that will enable them to do so. Anyone who does graduate study should keep in mind that the requirements for such study usually include a reading Knowledge of two foreign languages, usually French, German, or Russian.

The courses open to freshmen will continue work begun in high school. Students will probably want to choose some of their courses in areas in which they have already acquired some familiarity, but for the sake of intellectual stimulation and to avoid being limited in their range of future choices, they should also elect courses in fields that are wholly new to them.

The Major (B.A. or B.S.)

A major consists of a number of courses in the same area. A major usually includes twelve term courses taken for the most part in the Junior and Senior years. Majors are offered by departments or by interdisciplinary programs. In many departments and pro-
Comparative Literature 316a*English 316b (26416), Renaissance Lyric Poetry. Thomas Greene.
MW 2:30-3:45 Not CR/F I(c)
Readings in Petrarch, Ronsard, Du Bellay, Wyatt, Shakespeare, and Donne, with special attention to the relationship between language and selfhood, as well as the relationship between inherited traditions and individuality. Prerequisite: reading knowledge of French.

Comparative Literature 338a*English 338b (26453), Joyce and Mann.
James Snead.
MW 1:30-2:45 Not CR/F I(c)
A comparison of the major works of Joyce and Mann in light of their implications for the development of the twentieth-century novel, with an emphasis on Ulysses and The Magic Mountain. Alternate reading of works by two writers with focus on the transformation of mythic and philosophical sources; medievalism; typical rhetorical figures and modes; anti-traditional critical reception. Reading knowledge of German required for Comparative Literature majors, recommended for others. Texts available in translation.

TTh 1:30-2:45 Not CR/F I(c)
Close readings of English, German, French, and American narrative. Analysis of the relation between the discursive and representational demands of fiction in forms ranging from early epistolary and journal novels to first-person narratives, to authorial narrations and narrative realism. Texts by Richardson, Diderot, Goethe, Goldsmith, Lados, Klesl, Balzac, and Dickens. Reading knowledge of French required for Comparative Literature majors, recommended for others.

Comparative Literature 368a*English 368b (26468), Short Prose of the Twentieth Century. Howard Stern.
MW 3:30-4:45 I(c)
An investigation of an area delimited by several genres, including the poem, feuilleton, philosophical aphorism, and essay, with emphasis on the technical issues of poetics, interpretation, and translation. Works by Kafka, Beckett, Ponge, Calvino, and others. Reading knowledge of French, German, or Italian recommended for Comparative Literature majors, recommended for others.

Comparative Literature 488a or b (26488), Directed Reading and/or Individual Research. David Marshall and staff.
Hours to be arranged with adviser Not CR/F I(c)
Special projects set up by the student in an area of his own particular interest, with the help of a faculty adviser and the Director of Undergraduate Studies. Intended to enable the student to cover material not otherwise offered by the department. The project must terminate with at least a term paper or equivalent, and must have the approval of the Director of Undergraduate Studies. Enrollment limited to Comparative Literature majors.

Comparative Literature 489a (26489), The Senior Colloquium.
Jennifer Winke and staff.
T8-10 P.M.; disc. Th I HTBA Not CR/F I(c)
For description see Literature 489a. For Senior Comparative Literature students only.
A candidate for the B.S. degree must take, in addition to the courses in each of three of the following categories: analysis (25 courses between 300 and 349); statistics and applied mathematics (courses between 241 and 260, except 250a); algebra and number theory (courses between 350 and 399); geometry and topology (courses between 400 and 449); logic and foundations (courses between 450 and 490).

All Mathematics majors are urged to take at least one of Computer Science 222a or b or 440a, which may be counted as a term course in applied mathematics. In some instances permission may be granted to take additional required term courses in other departments (e.g., Computer Science, Engineering and Applied Science, History of Science, History, or Medicine).

A candidate for the B.S. degree must take, in addition to the term courses required for the major in Mathematics, at least two advanced courses in the physical sciences, to be chosen with the approval of the Director of Undergraduate Studies.

Any student interested in mathematical research as a career is urged to take Mathematics 230, 301a, 305b, 310a, 350a, and 370b. A sample program for such a student might consist of these courses plus from Mathematics 430b, 438b, 270a, and 450b. Students with more interest in teaching mathematics or in applications of mathematics should consider Mathematics 222a or b and 250a. A program for such a student might consist of Mathematics 222a or b, 241a, 242b, 244a or b, 320a, 320b, 350a, and 270a or 450b.

The intensive major: Candidates for a degree with an intensive major in Mathematics are expected to include at least two terms of graduate coursework, or of equivalent independent study, in their programs. Familiarity with the material of the following courses should be considered prerequisite to graduate courses in the respective categories: Algebra: two courses numbered 500 or higher; Analysis: Two courses numbered 300-399; Geometry and Topology: Mathematics 250a, 350a, Logic and Foundations: Mathematics 270a, 450b, 460b.

Senior requirement: A student majoring in Mathematics is required to take any of the courses numbered 222a or b or above.

A student majoring in Mathematics will be eligible for the Bachelor of Arts degree in Mathematics at their Senior Commencement. Required are: (1) anything numbered 300 or higher, most of which must be completed with a High Pass or better; (2) a knowledge of mathematical terminology in a foreign language of importance for mathematical research (e.g., French, German, or Russian); (3) satisfactory performance on a general oral examination.

A master's program is in no sense a substitute for the B.A. or B.S. program; it is designed to accommodate a very few exceptional students who, given accelerated or independent study, can satisfy the department as the command of the content of the normal undergraduate program.

Eligibility for advanced standing in any department is in no sense a substitute for the B.A., or B.S. program; it is designed to accommodate a very few exceptional students who, given accelerated or independent study, can satisfy the department as the command of the content of the normal undergraduate program.

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REQUIREMENTS OF THE MAJOR

Prerequisite: None

Number of Courses: B.A. Degree—10 term courses; B.S. Degree—12 term courses

Distribution of Courses: B.A. Degree—2 courses in 3 categories chosen among (a) analysis, (b) statistics and applied math, (c) algebra and number theory, (d) geometry and topology, (e) logic and foundations, with course range above; B.S. Degree—same, and a advanced-level course in the physical sciences with approval of DUS.

Specific Courses Required: Math 230 or the combination of Math 222a and 222b.

Substitution Permitted: CompSci 221a or b, or 440a, or courses in other departments, with permission of DUS.

Senior Requirements: Oral presentation on topic selected by the faculty in the seminar.

Intensive Major: 3 courses on graduate level counted among the required courses.


An introduction of some of the fundamental ideas of modern mathematics for a small group of freshmen interested in the serious study of mathematics.

The seminar is built around Mathematics 230, Vector Calculus and Linear Algebra, which must be taken concurrently. The Early Concentration program expands the topics covered in Mathematics 230—the algebra of finite dimensional vector spaces, and the usual notions of calculus extended to functions of several variables—and applies them in other areas of mathematics. Possible areas include metric spaces, topological spaces, Hilbert spaces, Fourier series, and differential equations. Candidates for enrollment should have a strong preparation in mathematics, particularly in calculus, as shown by a score of at least 80 on the BC Advanced Placement Test in Mathematics or by other comparable indications. Counts toward the major.

INTRODUCTORY COURSES

These courses do not count toward the requirements of a major in Mathematics.

Mathematics 111a or b, CALCULUS I. Robert Szczarba [F], Asger Aaboe [Sp], and staff.

Limits, continuity. Differentiation of elementary transcendental functions, and applications. No prior acquaintance with calculus is assumed. Not open to students who have completed Mathematics 110.*

Mathematics 112a, CALCULUS OF FUNCTIONS OF ONE VARIABLE I. Serge Lang and staff.

Limits, continuity. Differentiation of elementary and transcendental functions, and applications. No prior acquaintance with calculus is assumed. Not open to students who have completed Mathematics 110.*

Mathematics 114b, CALCULUS II. Robert Szczarba and staff.

Integration of Mathematics 111a. Change of variable in integrals, integrals in polar coordinates, computation of areas and volumes. Rudiments of vector analysis, differentiation of several variables, with applications. After Mathematics 111a or 112a.

Mathematics 115a or b, CALCULUS OF FUNCTIONS OF ONE VARIABLE II. Howard Garland [F], Serge Lang [Sp], and staff.

For sections see the Fall or Winter Supplement IV (69).

Integration of Mathematics 112a. The definite integral and the fundamental theorem of calculus. Techniques of integration. Polar coordinates. Taylor series. Physical and geometrical applications. After Mathematics 111a or 112a, or by permission. To freshmen with some preparation in calculus. One section that gives greater emphasis to applications is taught by a member of the Engineering faculty.

Mathematics 116a (65555), CALCULUS I: THEORY AND APPLICATIONS.

Dolf Schmid.

MWF 10:30-11:20 IV(33)

The content and prerequisites of 116a are similar to those of 111a, but the emphasis is geared to students with a strong interest in abstract mathematics. Not open to students who have completed Mathematics 111b or 112a.

Mathematics 117b (65565), CALCULUS II: THEORY AND APPLICATIONS.

Dolf Schmid.

MWF 10:30-11:20 IV(33)

Integration of Mathematics 116a. The content is similar to that of Mathematics 114b differing only in terms of presentation, which emphasizes abstraction as well as applications. After Mathematics 111a, 112a, or 116a. Not open to students who have completed Mathematics 114b or 115b.

Mathematics 120a or b, CALCULUS OF FUNCTIONS OF SEVERAL VARIABLES.

James Lee [F], Ronald Coifman [Sp], and staff.

For sections see the Fall or Winter Supplement IV (69).

Analytic geometry in three dimensions, using vectors. Real-valued functions of two and three variables, gradient and directional derivative, level curves and surfaces, maxima and minima. Parametrized curves in space, motion in space, line integrals; applications. Multiple integrals, with applications. After Mathematics 111a or 112a or by permission.

Two sections that give greater emphasis to applications are taught by members of the Engineering faculty in the fall term; the spring.

IMMEDIATE AND ADVANCED COURSES

These courses count toward the requirements of a major in Mathematics.

Mathematics 222a, LINEAR ALGEBRA AND MATRIX THEORY.

Lectures (65678) MWF 10:30-11:20 Douglas Pickrell IV(68)

Disc. 1 1HTRA.

Mathematics 222b.

Lectures (65679) 7th 9-10:15 George Moskow IV(68)

Disc. 1 1HTRA.

Introduction to the applications of vector spaces in algebra, analysis, and geometry. Linear algebra, determinants, eigenvalues, quadratic forms, principal axes of linear programming.

Last offered in 1984-85.

Tale College Programs of Study 1984-85
Mathematics 222b, LINEAR ALGEBRA AND MATRIX THEORY.

Mathematics 230, VECTOR CALCULUS AND LINEAR ALGEBRA.

Mathematics 241a, Ordinary Differential Equations.

Mathematics 242a, Theory of Statistics.

Mathematics 250a, Vector Analysis.

Mathematics 260b, Analytical Methods.

Mathematics 270a, Set Theory.

Mathematics 303a, Introduction to Analysis.

Mathematics 305b, Real Analysis.

Mathematics 310a, Introduction to Complex Analysis.

Mathematics 310b, Intermediate Complex Analysis.

Mathematics 320a, Measure Theory and Integration.

Mathematics 350a, An Introduction to Abstract Algebra.

Mathematics 353b, Representations of Finite Groups.
**[Mathematics 344b, Number Theory. 1985–86]**

Mathematics 370b (65865), Field and Galois Theory. Paul Vojta. MWF 1:30-2:20 IV(36)

The theory of fields and Galois theory, including finite fields, solving equations by radicals, and the fundamental theorem of algebra. After Mathematics 350a.


Newton's equations and the Galilean group; the Euler-Lagrange and Noether's theorem; the Kepler problem and rigid body motion; symplectic manifolds and Hamiltonian mechanics.

Mathematics 440b (65901), Differential Geometry. George Moskowitz. TH 9-10.15 IV(31)

Applications of calculus to the study of the geometry of curves and surfaces in Euclidean space, intrinsic differential geometric properties of manifolds, connections with non-Euclidean geometries and topology. After Mathematics 230 or 250a or the equivalent.

Mathematics 450b (69051), Recursive Function Theory. 1985–86

Mathematics 460a (65926), Philosophical Foundations of Mathematics. Philip Scowcroft. 2THRA Not CR/F IV(0)

Various philosophical positions with respect to the foundations of mathematics, including realism, constructivism, and finitism.

Mathematics 470a or b (65916), Individual Studies. Consult the Director of Undergraduate Studies. Meets RP IV(0)

Individual investigation of an area of mathematics outside of those covered in regular courses, involving directed reading, discussion, and either paper or examination. A written plan of study approved by the student's adviser and the Director of Undergraduate Studies is required. The course may normally be elected for only one term.

**COURSES IN OTHER DEPARTMENTS THAT ARE PARTICULARLY RELEVANT TO THE MAJOR**

The following courses may, with the permission of the Director of Undergraduate Studies, be counted with Mathematics courses towards requirements of the major.

Mathematics 221a or b (27547), Introduction to Computer Science. Perls. TH 1-1.30 Not CR/F IV(26)

Introduction to Computer Science 333a (62355), Linear Programming and Extensions. Denardo. TH 1:30-2.15 Not CR/F IV(27)

Introduction to Management Sciences 334a (62355), Introduction to Management Sciences. Penrose. TH 9-10.15 Not CR/F IV(26)

**MATHEMATICS AND PHILOSOPHY**

The following courses may, with the permission of the Director of Undergraduate Studies, be counted with Philosophy courses towards requirements of the major.

Mathematics 344b, Number Theory. 1985–86

Mathematics 440b (65865), Field and Galois Theory. Paul Vojta. MWF 1:30-2:20 IV(36)

The theory of fields and Galois theory, including finite fields, solving equations by radicals, and the fundamental theorem of algebra. Mathematics 350a.


Newton's equations and the Galilean group; the Euler-Lagrange and Noether's theorem; the Kepler problem and rigid body motion; symplectic manifolds and Hamiltonian mechanics.


Newton's equations and the Galilean group; the Euler-Lagrange and Noether's theorem; the Kepler problem and rigid body motion; symplectic manifolds and Hamiltonian mechanics.


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Newton's equations and the Galilean group; the Euler-Lagrange and Noether's theorem; the Kepler problem and rigid body motion; symplectic manifolds and Hamiltonian mechanics.
(3) one of the seminars designated as fulfilling the Senior requirement.

Requirements (1), (2), and (3) must be satisfied separately; however, a student may satisfy (2) and (3) by taking two designated seminars, provided that at least one of them is in Philosophy.

Senior requirement: Each year certain seminars offered by the Mathematics and Philosophy departments are designated as fulfilling the Senior requirement of this major. Subjects covered in these seminars vary from year to year. A student who selects one of them to satisfy requirement (3) above should be expected to give a presentation within the seminar on a topic selected in consultation with the instructor. These seminars may be taken at any time after a student has completed Mathematics 270a and Philosophy 204a.

The seminars fulfilling the Senior requirement for 1984–85 are Philosophy 449a, Probability, Induction, and Decision Theory; Philosophy 452b, Symmetry and Physical Law; and Mathematics 460a, Philosophical Foundations of Mathematics.

A typical program satisfying the major might consist of:

Mathematics 110a or b, 222a or b, 270a, 320a, 450b, and designated seminars;

Philosophy 101a, 204a, 222a, 449a, and designated seminars and presentations.

Majors should consult Walter Feit and Edward Hinds.

REQUIREMENTS OF THE MAJOR

Prerequisites: Math 120a or b, Phil 204a
Number of Courses: 12 term courses (within which the prerequisites and Senior seminar are included)
Distribution of Courses: At least 5 in each subject
Specific Courses Required: Math 270a, 450b, and Math 460a or Phil 449a, advanced Phil course with substantive logical component
Senior Requirement: Senior seminar

MATHEMATICS AND PHYSICS

A minimum of fourteen term courses in mathematics and physics above Sophomore level is required, with at least six in each of the two subjects.

Senior essay on a topic appropriate for the combined major and acceptable to both the Physics and the Mathematics departments is also required. A student must present an oral report on this essay to the Mathematics department. Majors should consult Walter Feit and Edward Hinds.

REQUIREMENTS OF THE MAJOR

Prerequisites: Math 120a or b, Phys 110a, 110b, or 182a, 182b, or 204a, 204b, or 205a, 210b; and Phys 161La, 161Lb, or 201La, 201Lb
Number of Courses: 14 term courses above Sophomore level (within which the prerequisites and Senior essay are not included)
Distribution of Courses: At least 6 in each subject, Math at level 222 or above, Phys at level 220 or above
Specific Courses Required: None
Senior Requirement: Senior essay on topic acceptable to Physics and Mathematics depts; oral report on essay to Mathematics dept
Ezra Stiles, and Trumbull. At the head of each college is a resident master. In each college a dean advises students on both academic and non-academic matters. Associated with the master and the dean are about fifty members of the faculty drawn from different departments and schools of the University, a few of whom reside in the college and others of whom have offices there.

Upon entrance, each Freshman is assigned to one of the twelve residential colleges. During their first year, all Freshmen are required to live on campus. Except for those Freshmen affiliated with Timothy Dwight or Silliman Colleges, Freshmen live in a quadrangle at the center of the University known as the Old Campus; those living on Old Campus may take a limited number of meals in their college, and they participate fully in its life. After Freshman year most students live on campus in their colleges, with about ten percent of upperclassmen choosing to live off campus. Whether they live on campus or off, undergraduates normally continue as members of the same college throughout their undergraduate careers.

THE UNDERGRADUATE CURRICULUM

One of the distinguishing features of a liberal education is that it has no single definition. Yale consequently does not prescribe any specific course to be taken by a student, but instead urges each undergraduate to design a program of study suited to his own particular needs and interests from the multitude of courses available to college students in a university.

It is also true of a liberal education that it is neither too narrowly focused nor too diffuse. As a matter of educational policy, Yale College has always stood behind the principle of distribution in studies as strongly as it has supported the principle of concentration. Thus Yale requires that each student choose in the later years of college an area of concentration in one of the major programs or departments, while also expecting that the student's course of study be characterized, particularly in the earlier years, by a reasonable diversity of subject matter and approach. The faculty of Yale College has therefore formally declared its support of the principles embodied in the Distributional Guidelines (see GUIDELINES FOR THE DISTRIBUTION OF STUDIES below). In addition, all undergraduates must fulfill the Distributional Requirements, which constitute the only specific rules limiting the selection of courses outside a student's major program.

DISTRIBUTIONAL REQUIREMENTS

Distributional Requirements for the Freshman Year and for the First Two Years. One of the chief objectives of these Distributional Requirements is to assure that in the first two years of their undergraduate education students elect courses from a variety of departments and in this way become exposed to different ideas and various ways of thinking. Many students come to Yale with advanced preparation in one or more fields. Early in their college careers, such qualified students ought to take advantage of any head start they may have in a subject to pursue it at a higher level than would otherwise be possible; a college course in a familiar subject at a more advanced level often discloses unfamiliar aspects of the subject. In addition, in disciplines like mathematics and languages, where the maintenance and improvement of skills greatly depend on continuing interest, they also often serve as a springboard for further study. Thus, with regard to the distributional requirements for the first two years, Yale College wishes to encourage students to develop intellectual interests, to pursue studies for the sake of intellectual interests, to explore some subjects that they may not study as part of the department or program in which they are majoring, and to take advantage of any head start that they may have in a subject.

1. Distributional Requirement

Freshmen may take no more than six Group I courses (except that a student may take as many as seven course credits in the English language). At least two course credits in Group II must be taken in a foreign language at the intermediate level. These requirements are intended to ensure that students take a foreign language at the intermediate level in their first year and then study a foreign language at the advanced level in subsequent years. The requirements also serve to ensure that students have a broad background in the humanities and social sciences.

2. Distributional Requirement

In meeting the Distributional Requirements, the student must take at least two credits in Group I or II.

Distributional Requirements for the Bachelor's Degree. Requirements for the Bachelor's degree all students can complete their studies in their major program with a variety of foreign language courses. Yale does not require prescriptive requirements in any distributional group. Instead, it encourages undergraduates to explore intellectual interests, to pursue studies in different fields, and to develop intellectual curiosity. In addition, the requirements are designed to ensure that students take a foreign language at the intermediate level in their first year and then study a foreign language at the advanced level in subsequent years. The requirements also serve to ensure that students have a broad background in the humanities and social sciences.

3. Distributional Requirement

To qualify for the bachelor's degree, students must complete a minimum of 30 credits drawn from at least four groups. A student must complete at least 12 credits of coursework in the humanities, and at least 12 credits in the natural sciences or social sciences. In addition, students must complete at least 12 credits in the arts and humanities, and at least 12 credits in the natural sciences or social sciences. Finally, students must complete at least 12 credits in the social sciences or humanities, and at least 12 credits in the natural sciences or social sciences. In addition, students must complete at least 12 credits in the arts and humanities, and at least 12 credits in the natural sciences or social sciences.
the head of each college is a resident master. Students on both academic and non-academic master and the dean as fellows are about fifty n from different departments and schools of m reside in the college and others of whom man is assigned to one of the twelve residential if, all Freshmen are required to live on campus. affiliated with Timothy Dwight or Silliman a quadrangle at the center of the University those living on Old Campus may take a limited ege, and they participate fully in its life. After s live on campus in their colleges, with about n choosing to live off campus. Whether they graduates normally continue as members of the undergraduate careers.

GRADUATE CURRICULUM

Features of a liberal education is that is has no quently does not prescribe any specific course t instead urges each undergraduate to design a his own particular needs and interests from the e to college students in a university. ducation that it is neither too narrowly focused of educational policy, Yale College has always of distribution in studies as strongly as it has concentration. Thus Yale requires that each years of college an area of concentration in one departments, while also expecting that the stu-racterized, particularly in the earlier years, by a ject matter and approach. The faculty of Yale lly declared its support of the principles embodGuidelines for the Distributional Requirements (see) distributional groups by the end of the student's first four terms of enrollment. In meeting the Distributional Requirements for the Bachelor's Degree, the student must take at least two course credits in each of the four Distributional Groups by the end of the student's first four terms of enrollment.

Distributional Requirements for the Bachelor's Degree. The Distributional Requirements for the Bachelor's Degree are intended to assure that by graduation all students can confidently assert that they possess a competence in a foreign language at the intermediate level and that their work, including their studies in their major programs, has been grounded in a sound acquaintance with a variety of fields of inquiry and approaches to knowledge. Yale does not require prescribed courses in specific subjects, but instead encourages undergraduates to design programs that best reflect their own intellectual interests, that open the maximum range of intellectual opportunities through which those interests can be expanded, and that direct their studies always to that most elusive of goals, a liberal education. Thus the third Distributional Requirement relates to the student's entire academic career.

3. Distributional Requirements for the Bachelor's Degree.

To qualify for the bachelor's degree, a student must earn at least twelve course credits drawn from outside the Distributional Group that includes the major. At least two course credits must be drawn from each one of the four Groups. A student must also demonstrate competence in a foreign language at the intermediate level, either by passing the appropriate
courses or by examination.* No more than six course credits in a single Group may be employed to meet the Distributional Requirements for the Bachelor's Degree, except that a student who takes more than four course credits in order to attain the required level of competence in a foreign language may offer as many as eight course credits in Distributional Group I.

For the purpose of distribution in Yale College, courses are classified into four Groups according to the following general scheme:†

**Group I:** language and literature, English and foreign, ancient or modern.

**Group II:** architecture; art; classical civilization; film; history; history of art; history of science, history of medicine; humanities; music; philosophy; religious studies.

**Group III:** anthropology; archeology; economics; linguistics; management sciences; organizational behavior; political science; psychology; sociology.

**Group IV:** astronomy; biology; chemistry; computer science; engineering; forestry and environmental studies; geology and geophysics; mathematics; molecular biophysics and biochemistry; physics; statistics.

Beginning with students entering in 1983, a student is required to demonstrate competence at the intermediate level in a foreign language either upon entrance or before graduation, preferably by the end of Junior year. This requirement may be met by presenting an appropriate Advanced Placement Test score, or by passing an examination at Yale, or by passing an intermediate-level course in a foreign language at Yale. The languages offered at Yale in which a student may attain the required competence are: Arabic, Chinese, Czech, French, German, classical Greek, Hausa, Hebrew, Italian, Japanese, Latin, Polish, Portuguese, Russian, Serbo-Croatian, Spanish, Swahili, and Yoruba. Information about appropriate Advanced Placement Test scores, relevant courses, and the nature of the examinations in these languages is contained in Chapter III in the introductory statements of the departments offering courses in foreign languages.

Students who possess competence in a language other than those listed here, either because it is their native language, or because they learned it abroad or by study at another university, or by some other means, should consult the appropriate Director of Undergraduate Studies or their Residential College Dean to arrange for an examination. Students who, for physiological reasons, are not able to complete the language requirement may petition the Committee on Honors and Academic Standing for a waiver of the requirement. The Committee may, in individual cases and on petition of the student's major program, partially or fully waive the requirement for sound and weighty academic reasons.

*Students who entered Yale College at any time before 1983–84 are not required, in order to qualify for graduation, to demonstrate competence in a foreign language at the intermediate level.

†Some courses may fall into another Distributional Group in addition to the one indicated in this classification. The Group number of a course is the Roman numeral in the data line of the course listed in Chapter III.

GUIDELINES FOR THE STUDENT

Although educated men and women know that a liberal education should involve more than the acquisition of information. To suppose that anyone can think clearly and act wisely in matters of foreign policy without learning a foreign language is an illusion: words are indispensable to thinking and writing, and to understand and use them skillfully, one must know their meaning and be able to communicate it to others.

A student should also do formal and informal reading in a foreign language. A person can fulfill the requirement of reading in a foreign language and experience the thrill of discovering what others have written while deriving from it knowledge and understanding that this is the way to use a foreign language. It is possible by his augmented skill. To study the uses made of it by others and to experience the thrill of writing while deriving from it knowledge and understanding of one's own writing, is an illusion: words are indispensable to thinking and writing, and to understand and use them skillfully, one must know their meaning and be able to communicate it to others.

1. Students should be able to use a foreign language effectively. To suppose that anyone can think clearly and act wisely in matters of foreign policy without learning a foreign language is an illusion: words are indispensable to thinking and writing, and to understand and use them skillfully, one must know their meaning and be able to communicate it to others.

2. Students should be able to use a foreign language effectively. To suppose that anyone can think clearly and act wisely in matters of foreign policy without learning a foreign language is an illusion: words are indispensable to thinking and writing, and to understand and use them skillfully, one must know their meaning and be able to communicate it to others.

*Guideline with the requirement that students who majored in foreign languages should have a foreign language other than their own, and that such abilities increase as proficiency is increased.

†Some courses may fall into another Distributional Group in addition to the one indicated in this classification. The Group number of a course is the Roman numeral in the data line of the course listed in Chapter III.

*Students who entered Yale College at any time before 1983–84 are not required, in order to qualify for graduation, to demonstrate competence in a foreign language at the intermediate level.

†Some courses may fall into another Distributional Group in addition to the one indicated in this classification. The Group number of a course is the Roman numeral in the data line of the course listed in Chapter III.

Yale College Programs of Study 1985–86
than six course credits in a single
Distributional Requirements for the
who takes more than four course
level of competence in a foreign
t course credits in Distributional

Yale College, courses are classified into
general scheme:†

English and foreign, ancient or modern:
civilization; film; history; history of:
art; humanities; music; philosophy;

economics; linguistics; management;
political science; psychology;

chemistry; computer science; engineer-
ies; geology and geophysics; math-
chemistry; physics; statistics.

in 1983, a student is required to dem-
strate level in a foreign language either
preferably by the end of Junior year.

presenting an appropriate Advanced
examination at Yale, or by passing an
language at Yale. The languages
attain the required competence are:
man, classical Greek, Hausa, Hebrew,
guese, Russian, Serbo-Croatian, Span-
in about appropriate Advanced Place-
the nature of the examinations in
eter III in the introductory statements
in foreign languages.

in a language other than those listed
language, or because they learned it
urally, or by some other means, should
Undergraduate Studies or their Resi-
or an examination. Students who, for
complete the language requirement
ors and Academic Standing for a waiver
may, in individual cases and on petition
ally or fully waive the requirement for

at any time before 1983–84 are not required,
monstrate competence in a foreign language

GUIDELINES FOR THE DISTRIBUTION OF STUDIES

Although educated men and women may never agree about everything
that a liberal education should include, nearly all do agree on the proposi-
tions below, which are intended to serve the student as guides in his choice
of studies. The specific courses by which the student achieves his educational
goals must depend on individual interests and needs, but all students should
select courses according to a reasoned plan that embodies each of the
following Guidelines.

1. It is axiomatic that educated men and women should be able to express
themselves effectively in their own language, both in speech and in writing.

To suppose that anyone can think clearly even though he cannot write
clearly is an illusion: words are the most basic tools of thought. A person
who cannot use them skillfully will be handicapped not only in communi-
cating ideas to someone else, but also in defining, developing, and under-
standing them himself. Students should therefore choose at least one course,
and preferably several, in which they write papers that are evaluated closely
for clarity of expression. The most obvious department in which to find
such courses is English; its introductory courses (English 10a, 11a, 15, 16b,
120a or b, 121b, 125, 129) offer frequent opportunities for writing. In addition,
many courses in various departments, in the sciences and social sciences as
well as in the humanities, provide special attention to prose composition.
Among these are courses which have been especially designed to emphasize
writing; they are designated "Writing Intensive" (WI) in Chapter III.

A student should also do formal course work in English literature. Using
language effectively depends to a large extent upon the scope and quality of
one’s reading. A person can fully grasp the possibilities of the English
language, and experience the thought and feeling it opens up, only by a
study of the uses made of it by its greatest masters. By joining the study of
writing with the study of literature, a student will inevitably improve his
own writing while deriving from his reading an increased pleasure made
possible by his augmented skill. The study of literature leads to an expansion
of one’s experience and personal horizons, and is a continuing source of
instruction and pleasure for the duration of one’s life. Above all, reading
widely and deeply enlarges the power of the imagination, which in one way
or another underlies almost all intellectual endeavor.

2. Students should be able to understand, speak, read, and write a lan-
guage other than their own, and should be acquainted with the literature of
that language. Such abilities increase subtlety of mind and sharpen sensitiv-
ity to the use of one’s own language. Students should know at least one
foreign language well enough to speak it fluently, if it is a modern language,
and to read it freely and with enjoyment. Such a skill, if preserved through
use, will be an intellectual and personal asset throughout a person’s entire
lifetime. Professionally it can be equally important. Most careers today are
potentially international in their range. Businessmen, lawyers, teachers,
physicians, writers, and artists—anyone in any profession has superior
advantages and opportunities if he knows at least one foreign language, and
preferably several. It is for these reasons that Yale College augments this
Guideline with the requirement that each student demonstrate competence
in a foreign language at the intermediate level, preferably by the end of
Junior year.

Using his skills in language, a student should also enter into the literature
of a foreign language, because only through such study can a person
experience another culture fully enough to broaden his range of feeling and judgment. The question of which literature or literatures to study will depend on a student's preparation and future goals. Graduate schools, for example, commonly require a reading knowledge of at least two modern foreign languages (usually French, German, or Russian); for some fields of graduate work, a knowledge of Latin or Greek is required as well. But a student should also consult personal interests and tastes: a student who likes English Romantic poetry, for example, might study French or German Romantic poetry in the original; one who is interested in Spenser or Milton might want to read Virgil in Latin.

In starting a new language in college, students should plan to take at least two years of study or an intensive course covering that amount of material in one year, in order to acquire fluency in speech and writing. They may then proceed to a literature course in that language. Entering Freshmen who have already acquired a high degree of proficiency in one foreign language should seriously consider taking a literature course in that language during their Freshman year, because both skill and confidence in languages can easily wane with a year's disuse.

3. Just as the study of a foreign language and its literature helps to overcome geographical provincialism, so does the study of other times help to correct temporal provincialism. An educated person needs a historical perspective on his own times, and that can come only from studying other civilizations and cultures, either those from which his own culture has developed, or those different from his own. Certainly no student ought to leave college without having studied the history, art, music, philosophy, religion, or literature of the ancient world or the Middle Ages. Ideally, one ought to study the arts, artifacts, and ideas of both the modern and the ancient worlds, but if one must choose between the two, it would be wise to begin with the ancient. As for any student who may not have had a good general course in American history in secondary school, he should obviously take one in college.

4. Mathematics is the basic language of the natural and the social sciences, and has become a useful tool in many of the humanities. So pervasive are mathematical techniques that contemporary men and women may not consider themselves truly educated until they have an understanding of the fundamentals of mathematics. At a minimum students should have a proficiency in mathematics at the level of calculus. Students without this foundation should probably acquire it in Mathematics 111a–114b or 112a–115b before proceeding further. Those wishing to open opportunities for advanced study in a variety of fields other than mathematics may need to take appropriate advanced courses in mathematics. Since not every subject requires the same kind of mathematical knowledge, the most immediately useful course for a student's purpose may not be found in the Mathematics department itself but rather in one or more of the following departments or programs: Computer Science, Economics, Engineering and Applied Science, Molecular Biophysics and Biochemistry, Political Science, Psychology, Sociology, or Statistics. These departments offer courses in the mathematical or statistical methods used in their disciplines. Whatever course a student chooses in order to broaden his mathematical knowledge, however, skill in mathematics should be maintained, because, like language, it is likely to dissipate if it is not used.

5. Acquiring a detailed familiarity with several natural and applied sciences is a practical necessity for some students. For all students, however, being educated means developing abilities that have been achieved, and what it might contribute in the last three hundred years scientific rational inquiry and knowledge with "knowing" or how some scientific facts others. Only by studying a science can educated citizens need: an ability to distinguish quackery from responsible knowledge which are known and which unknown, who science. Studying a science means to appreciate both the close mentalists and the careful observation of theorists and the careful observation of mentalists. Only by studying a science can one appreciate the beauty and complexity. Students with little previous preparation courses without prerequisites in all of the Residential College Seminars. Intro available for students with more background. It is impossible to overemphasize study of science early in college, especially to students with a strong inclination toward scientific careers.

6. Finally, to understand the duties of a human being among other human beings with at least one of the social sciences. Sciences often rely heavily on mathematical rather than on things. At a time when problems are increasing, the future of majorly and significantly on the insights achieved by the educated person should have some understanding and are learning about living together. Not one has to have a knowledge of the cultures of people in America, as well as of those of Western Europe. The Yale curriculum contains a wide variety of social systems, governments, economics.

What a student ultimately derives from casual observation but which on, the insights achieved through the study of science early in college, especially to students with a strong inclination toward scientific careers.

In fulfilling these Guidelines, as in all other areas of academic study, students must seek broadly for advice and assistance from their advisers and Residential College Deans, in the Residential College Seminars. In the Residential College Seminars, students are learning about living together. Not one has to have a knowledge of the cultures of people in America, as well as of those of Western Europe. The Yale curriculum contains a wide variety of social systems, governments, economics.

What a student ultimately derives from casual observation but which on, the insights achieved through the study of science early in college, especially to students with a strong inclination toward scientific careers.
be educated means developing a broad view of what science is, what it has achieved, and what it might continue to achieve. One can be aware that in the last three hundred years science has come to be synonymous with rational inquiry and knowledge without realizing what a scientist means by “knowing” or how some scientific facts are more prone to change than others. Only by studying a science can one develop the critical faculties that educated citizens need: an ability to evaluate the opinions of “experts,” to distinguish quackery from responsible science, and to realize which things are known and which unknown, which are knowable and which unknowable, to science. Studying a science reveals new patterns of thought. One can learn to appreciate both the close analysis and deductive reasoning of theoreticians and the careful observations and manipulative skill of experimentalists. Only by studying a science can one share the excitement, delight, puzzlement, and beauty that scientists find in their work. To know science is to appreciate a thousand intricate coherences in nature, which are hidden from casual observation but which, once known, lend richness to everyday life.

Students with little previous preparation will find introductory science courses without prerequisites in all of the science departments and among the Residential College Seminars. Introductory courses on other levels are available for students with more background and for prospective science majors. It is impossible to overemphasize the advantages of beginning the study of science early in college, especially for those students with any inclination toward scientific careers.

Finally, to understand the duties and problems facing everyone as a human being among other human beings, students should become familiar with at least one of the social sciences. Like the natural sciences, the social sciences often rely heavily on mathematics, but their emphasis is on people rather than on things. At a time when the population of the world and its problems are increasing, the future of mankind’s achievements may depend significantly on the insights achieved through the social sciences. An educated person should have some understanding of what men have learned and are learning about living together. Modern Americans especially ought to have a knowledge of the cultures of Eastern Europe, Asia, Africa, Latin America, as well as of those of Western Europe and their own country. The Yale curriculum contains a wide variety of courses on these areas, dealing with social systems, governments, economies, histories, and cultures.

What a student ultimately derives from four years of study at Yale obviously depends in large measure upon his careful planning of a program of study. In fulfilling these Guidelines, as in pursuing their other educational goals, students should seek broadly for informed advice, from their faculty advisers and Residential College Deans, and from Directors of Undergraduate Studies or other faculty members in the various departments and programs. No adviser will prescribe a particular set of courses, and the responsibility of shaping a program is the student’s, but each student should make use of all the advice available in order to plan the most effective program. It would be impossible, and surely imprudent, for a student to attempt to map out at the beginning of his studies a firm schedule of courses for the next eight terms. Yet it is important for the student to think ahead, and always to plan with these principles in mind.

Although these Guidelines are not actual requirements (except that a student must display proficiency in a foreign language), Yale College expects that a student’s program will reflect these principles. Every student’s pro-
gram must be approved by his dean and adviser, and every reasonable program will be approved. A student whose program departs markedly from the Guidelines will be obliged to persuade the Residential College Dean and faculty program adviser that it will still achieve for the student in its own way the goals of a liberal education.

MAJOR PROGRAMS

Students seeking the B.S. or the B.A. degree with a major in science are expected to elect their majors at the beginning of Sophomore year, although a major in science may still be elected later if the student has completed the courses required to enter it. Sophomores interested in majoring in science should have their schedules approved by the Director of Undergraduate Studies or adviser designated by the department in which they wish to major. Students seeking the B.A. degree with a major in a field other than science are expected to elect their major at the beginning of Junior year. The schedules for Sophomore year of these students must be signed by a Sophomore adviser, chosen by the student, with whom the program has been discussed.

All candidates for a bachelor’s degree in Yale College must elect one of the major programs listed on page 28. The requirements for a major are described in general terms in the sections below, and in more detail at the beginning of the course descriptions of each department or program in CHAPTER III. In every case students plan their schedule of courses in their major subjects or fields in consultation with a representative of the department or program concerned, and must secure the consultant’s written approval. Students should acquaint themselves fully with all the requirements of the major they plan to enter, considering not only the immediate choice of courses but also the plan of their entire work in the last two or three years in college.

SELECTION OF A MAJOR

In designing a program of study, the student ought to plan for depth of concentration as well as breadth of scope. To study a subject in depth can be one of the most rewarding and liberating experiences a person can secure and can form the basis of the interests and occupations of a lifetime. Although no one should specialize to the neglect of distribution, knowledge advances by specialization, and one can gain some of the excitement of discovery by pressing toward the outer limits of human knowledge in a particular field. Intense study of a seemingly narrow area of investigation will often disclose ramifications and connections that alter perspectives on every other subject. Such study also sharpens a person’s judgment and acquaints him with processes by which new truths can be found.

In order to expose themselves to this kind of experience, students must choose a field of study that will be their major field, that is, the subject in which they will work more intensively than they do in any other. A list of possible majors in Yale College from which such a choice is to be made is given below on page 28. Specific requirements for each major are established by the department or program concerned and are explained in CHAPTER III.

Some students will have made a tentative choice of a major before entering college. Others will have settled on a general area—for example, the natural sciences or the humanities—while in secondary school. Those who feel certain of their choices should plan their programs as early as possible and obtain the approval of the Residential College Dean and faculty program adviser that it will still achieve for the student in its own way the goals of a liberal education.

THE MAJOR

The major consists of a number of courses taken in preparation for graduate work. Almost every department or interdisciplinary program requires that a student major in one of the three areas: the natural sciences or the humanities, or the social sciences. The specific requirements for each major are established by each department or program concerned and are explained in CHAPTER III.