

CAMPBELL
UNIVERSITY
SCHOOL OF ENGINEERING

National Academy of Engineering
Grand Challenges Scholars Program Proposal

Campbell University
School of Engineering

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Overview of Campbell School of Engineering

Campbell School of Engineering admitted its first class in Fall of 2016. Our inaugural class will graduate in May of 2020. We offer a B.S. in Engineering with concentrations in mechanical engineering, chemical engineering and electrical engineering. Our curriculum features a strong hands-on, project-based focus, with strong emphasis on the fundamentals, as well as four years of engineering design. We work to recruit and graduate a diverse cohort of students, with open admissions (any student accepted at the university may elect to major in engineering, with an alternate pathway for those who do not meet mathematics proficiency. Our goal is to widen the path to engineering, versus weed out students. Consequently, we are pleased that our program attracts a number of Division 1 athletes, military veterans, community college transfer students, non-traditional students, as well as women and traditionally underrepresented minorities. We offer small classes of at most 24 students, state-of-the-art equipment and labs, and all engineering courses are taught in a classlab which allows for seamless integration of labs, demos and projects into the “lecture” content. We currently have 180 students (freshman, sophomores and juniors) and 10 faculty lines. There is a strong emphasis on student internships (80-90% of our inaugural class secured internships after their sophomore year at companies such as Caterpillar, Pfizer, 3M, Rockwell Collins, First Quality, Grifols, Boon Edam, Mertek, etc.). There is also a strong emphasis on professional licensure, professional student organizations, student professional development and service (all first-year students must log a total of 50 hours of professional development and service outside of class). Located in rural Harnett County North Carolina, the School of Engineering partners with a variety of K12 school, and non-profit K12-focused organizations (like FIRST Robotics, the Girl Scouts, NCWIT, ChickTech, Professional Engineers of North Carolina and more) to impact STEM education and recruitment of diverse cohorts of students to STEM programs in our region. The Grand Challenges Scholars Program is therefore a natural fit for our students and curriculum.

GCSP Vision, Mission, and Goals

Campbell University Mission

The mission of Campbell University is to graduate students with exemplary academic and professional skills who are prepared for purposeful lives and meaningful service.

Campbell School of Engineering Mission, Vision and Values:

Mission

The mission of the School of Engineering is to provide transformational learning experiences for a diverse community of future leaders through an integrated and experiential approach to engineering education, grounded in meaningful service and Christian principles.

Vision

The vision of the School of Engineering is to be the leader in faith-based experiential engineering education serving diverse students and communities.

Values

Community, Ethics, Professionalism, Relevance, Resilience, Excellence, Service, Ownership, Professionalism

Proposed GCSP Mission, Vision and Goals:

GCSP Mission

To provide Campbell Engineering majors with transformational learning experiences that prepare them for careers which successfully address the four grand challenge themes for engineering in the 21st century: sustainability, health, security and joy of living.

GCSP Vision

To be an exemplary GCSP program located at a faith-based institution that serves diverse cohorts of students and the communities from which they come.

GCSP Goals

- To graduate a diverse cohort of at least 10 GCSP Scholars each year.
- To partner with the institution to provide unique opportunities for GCSP Scholars to complete the five component activities.
- To partner with organizations in our community to impact the fourteen grand challenges in rural North Carolina

The GCSP Mission, Vision and Values link to both the School of Engineering and university statements through the threads of exemplary academic and professional skills, transformational learning experiences, service to the communities in our region, and a commitment to educate a diverse cohort of engineering graduates. The GCSP embodies our eight values through both the grand challenges themselves and the five components on which students must focus their experiences in order to complete the program. The proposed structure of our GCSP supports the mission, vision and goals through its open admission criteria, partnership activities with both the institution and surrounding communities, and transformational learning experiences which will strengthen both the academic and professional skills development of our GCSP Scholars.

Grand Challenges Scholar Recruitment and Selection

Information about our GCSP will be included in all of our recruitment activities, including our website, our visitation day presentations, summer orientation and our ENGR 100 first-year seminar course. Students will be specifically recruited in ENGR 100 by our GCSP Scholars, although they may elect to apply to the program any time during their freshman and sophomore years. Students at the junior- and senior-level may apply to the program if they can complete program requirements before graduation. Transfer students (who are all required to take ENGR 100) will also have a two-year window during which they can elect to apply to the program (and can apply later if they can complete program requirements before graduation). Experiences completed prior to attending Campbell might be eligible for consideration as part of one or more GCSP competencies, if appropriate.

Student application process: Any engineering major is eligible to apply to the program during their first two years at Campbell. Interested students must complete the application form (see Appendix A) and submit to the GCSP Director by mid-semester (any semester during their first

two years). Information about applying to the GCSP, as well as the deadline for applications, will be included in the weekly school-wide email sent to all engineering majors each Monday. ENGR 100 instructors, the GCSP Director (who holds the position of Student Success Specialist) and the Dean (a former GCSP Director and Chair of the NAE GCSP Steering Committee for seven years) will all be available to mentor students through the application process. Students will be asked to select their GCSP thematic area at the time of application. They may elect to select one or two Grand Challenges on which to focus, within the thematic area, or they may defer that selection to their second year in the program to give them an opportunity to better understand their options.

Student Selection Process: The GCSP Steering Committee will consist of the GCSP Director, the Dean, and Faculty Representatives from each of the three concentration areas (mechanical, chemical and electrical). The Faculty Representatives will be rotating positions selected to serve three-year terms to ensure that all faculty have a baseline understanding of the GCSP. The Steering Committee will meet after the deadline for applications to review submissions and select students for admission to the program. Student essays will be an important part of the selection process as students will be expected to demonstrate their awareness of and eagerness to address the social and global issues embodied in the Grand Challenges, as well as their commitment to addressing their selected Grand Challenge thematic area/one or two grand challenges within their selective thematic areas. The program will work to admit as many students as possible, given its focus on diversity, with a goal of 15 students per cohort, in order to meet the goal of 10 or more GCSP graduates each year, for a maximum of 60 students total in the program. There is a minimum GPA requirement of 2.0 for students both applying to and admitted to the program. Students who fall below the 2.0 GPA must sit out of the program until their GPA reaches 2.0 or higher, to give the opportunity to focus their time and effort on their classes.

GCSP Experiences

Student admitted to the program will be assigned a GCSP Mentor from the Steering Committee to assist them in laying out the plan for their GCSP. The student's plan should be completed by the end of the semester in which they are admitted to the program and filed with the GCSP Director. The plan must indicate the student's selected Grand Challenge Thematic Area/Grand Challenges, as well as how they intend to complete the requirements for each of the five components, below. A summary matrix of component options can be found in Appendix B. Students will include a copy of the completed matrix with their plan.

GCSP students must meet each semester with their GCSP Mentor during Advising to review their progress and adjust their plan, as necessary. Mentors will complete a GCSP Semester Check-up Form (see Appendix C) and submit to the GCSP Director. Particular attention will be paid to students who are not on track or who are struggling to complete selected/required activities, with the goal of assisting these students in revising or adjusting their plan, accessing resources to assist them in making progress toward their goals, removing barriers, etc.

Five GCSP Student Competencies:

Each of the five competencies are listed, below, along with the options from which students are to select to successfully complete the component requirements. Careful attention has been given to ensure that different options are as similar as possible in terms of time and effort, strength of experience, etc. For each component, students may propose additional activities not listed below. All such proposals must be approved by the Steering Committee, must fully meet the requirements of the competency and be similar to listed options in terms of time and effort, strength of experience, etc.

Note that all experiences must meet these three requirements:

- a) The selected experience must focus on the student's selected Grand Challenge Thematic Area/Grand Challenges (with possibly the exception of the Social Consciousness experience).
- b) The selected experience must be approved by their GCSP Mentor prior to initiation in order to count toward GCSP program completion.
- c) Students must write both a one-page pre-essay discussing the connection of the selected experience to their selected GC Thematic Area/Challenge, preparatory work required, and learning goals for the experience, as well as a one-page post-experience reflection essay. These essays will constitute part of the student's portfolio to be submitted upon completion of the program as part of the final assessment by the GCSP Steering Committee.
- d) Students may adjust their curricular plan with respect to completion of the five competencies, in consultation with their faculty mentor, as they progress through the program and encounter different opportunities.

(i) Talent Competency: "This is a creative technical competency, development of which requires mentored project or research experience. Each GC Scholar must participate in a substantial team or independent project relating to a Grand Challenge theme or specific challenge. Some examples of the experiences that may support student development of the Talent Competency are: participation in formal undergraduate research programs, senior theses, on-site internships, or capstone design projects."

Campbell students will satisfy this competency through successful completion of either an individual or a team i) capstone (two semester) design project, ii) a summer REU program (of at least 9 weeks' duration), iii) an honors thesis (if they are in the Campbell Honors Program, at least one semester in duration), iv) a faculty-sponsored research project (of at least one semester's duration), or v) a national competition team project (such as the Human Rover Exploration Challenge, provided it aligns with the student's selected GC Thematic Area/Challenge(s)) (of at least one semester's duration)). [Note that our HERC Team has a detailed administrative structure with clear responsibilities and oversight, with participation to be verified by the sub-team or team captains and Faculty Advisor.] Students will be strongly encouraged to submit an application to present their project at the Annual Wiggins Memorial Symposium, which features original student work from across the campus.

(ii) Multicultural Competency: "Multicultural awareness is necessary for working effectively in an increasingly interdependent world. Students may participate in curricular or extra-curricular experiences that help students develop skills and attributes necessary for continued innovations"

in a global economy and address ethical issues of global concern. While an experience abroad lends itself more organically to development of multicultural competency, students may also choose to participate in a domestic experience that focuses on global or cross-/multi-cultural implications of a GC theme or problem. Some examples of the experiences that may allow students to develop this competency are: completion of formal coursework relevant to multicultural competency development; participation in global internships or those that emphasize global nature of engineering work; conducting research in global health or global environmental challenges, etc.”

Campbell students will satisfy this competency through successful completion of either i) a CU-approved study abroad engineering internship experience coordinated through the Campbell Dean of Global Engagement (of at least one week’s duration), ii) a global study abroad course (of at least three weeks’ duration and coordinated through the Campbell Dean of Global Engagement), iii) a global research project related to global health, environmental challenges, etc. (of at least one semester’s duration) or iv) other appropriate domestic multicultural experience or opportunity (in particular, those offered through the campus Office of Global Engagement, where appropriate). Study abroad internship experiences involve multiple team pre-trip meetings, planning, coordination, etc., in order for the student teams to complete the engineering projects within the allotted time frame. (Note that we have had eight students successfully complete one-week or semester-long global engineering internship projects connected to one or more of the Grand Challenges through global non-profit organizations; our next global engineering internship experience is planned for May 2018).

(iii) Multidisciplinary Competency: “Bridging engineering to other disciplines is essential for solving the NAE Grand Challenges. An overall curricular as well as co- and extra-curricular program must be designed to prepare students to work at the boundary between various engineering and non-engineering disciplines, such as public policy, international relations, business, law, ethics, human behavior, risk, medicine, the natural sciences, arts, etc. Each GCSP should have an institutionally tailored mechanism that thematically draws together the engineering and non-engineering curricular components of each student’s course of study. In other words, if a student chooses to develop this competency through a double-major or a minor in a non-engineering discipline, this choice must be intentional in weaving in a GC theme or problem. Some examples of relevant experiences include: participation in an explicitly interdisciplinary course or a GCSP seminar series.”

Campbell students will satisfy this competency through successful completion of the two-semester first-year engineering design sequence with a grade of “C” or higher in each course. This sequence is designed to provide a multidisciplinary experience where all engineering majors work together on multiple team-based projects. The course incorporates training and content from a variety of engineering topics, as well as chemistry, mathematics, oral and written communication, diversity and inclusion, and effective teaming. Students complete a global perspective project, a robot project, a fish tank dual controls project (temperature and salinity) and an open-ended design project (the majority of which are externally sponsored), as well as 25 hours of professional development training and service outside of class *each*

semester. Students must make the case for how their first-year design experiences (selected professional development and service activities, design project, global perspective project) have prepared them to address their selected GC Thematic Area/Grand Challenges.

(iv) Viable Business/Entrepreneurship Competency: “Implementing innovation is central to technology development. Each GC scholar must participate in a curricular or co-/extra-curricular experience that involves the process of translating invention and innovation into a viable business model for solution implementation or a market venture. This may be either risk-taking ventures for business or introducing technology for not-for-profits in the public interest. Examples of relevant experiences that students may choose to participate in include: submittal of an invention disclosure; participation in a start-up competition, a course in entrepreneurship; application for a patent or other form of intellectual property. In addition, students might elect to participate in an engineering entrepreneurship program such as VentureWell’s University Innovation Fellows Program.”

Campbell students will satisfy this competency through successful completion of either i) the annual CU Soup Idea Pitch Competition, ii) three or more entrepreneurship workshops at HQ Raleigh or HQ Fuquay, iii) submittal of an invention disclosure or application for a patent or other form of intellectual property, or iv) completion of a course in entrepreneurship with a grade of “C” or higher through the Lundy Fetterman School of Business at Campbell. Students may elect to use either their first-year or capstone design project as the basis for their invention, patent or intellectual property application (Campbell’s Intellectual Property Policy is available here: <http://courses.campbell.edu/content.php?catoid=2&navoid=110>).

(v) Social Consciousness Competency: “Working for the benefit of others is the foundation of a civil society. Students may participate in a curricular or extra-curricular component that deepens their social awareness and heightens their motivation to bring their technical expertise to bear on societal problems. For example, students may choose to develop this competency through some of the following experiences: completion of formal classes in social action; participation in internships for global service organizations such as Engineering World Health or Engineers Without Borders; participation in curricular service-learning experiences like Engineering Projects in Community Service (EPICS); conducting research that focuses on improving the human condition; significant meaningful participation in an institution’s community service or tutoring program. The number of hours expected for completing this competency will vary with the intensity of the activity, but it is expected to be substantial.”

Campbell students will satisfy this competency through either i) formal mentorship of a FIRST Lego League Team (at least one competition season in duration, 90+% attendance at team meetings, as well as attendance at the regional competition held here in Harnett County, usually on our campus). Note that all 13 elementary schools in Harnett County have a FIRST Lego League Team, including the elementary school across the street from our building, for GCSP students who may not have transportation; ii) serving as a tutor or Supplemental Instruction Leader for either the School of Engineering or the university (one or more semester in duration, 5-10 hours per week minimum); or iii) membership in the School’s Engineering

Ambassadors Network organization for at least one academic year and participation in at least 10 K12 outreach events (Girl Scout Day, NC FIRST Robotics Championship – held on campus, Science Olympiad Regional Competition – held on campus, NCWIT Aspirations Award Event, Visitation Day, ChickTech Workshop Day, individual K12 school workshop day, off-site K12 school classroom visit, GEARUP Day, etc.). Note that the School has an existing documentation system to track student participation in outreach events.

Thematic Continuity and Connectivity

To ensure that the students' selected Grand Challenge Thematic Area/Grand Challenge(s) are intentionally imbedded across and within each of the GCSP competencies for each GC scholar, all experiences used to satisfy the five competencies (with perhaps the exception of the Social Consciousness Competency) must relate to the student's selected Grand Challenge Thematic Area/Grand Challenge(s). It is the student's responsibility to make the case for this thematic connectivity as part of their pre-essay and such will be reviewed for compliance as part of the GCSP Mentor's approval of the proposed experience.

Programmatic and Individual Student Assessment

The GCSP Mentor provides the first line of assessment, given that they are responsible for reviewing the student's pre-essay and approving the proposed competency experience. When a student has completed the requirements for all five components of the program, they must submit a formal request for review (see Appendix D), which includes their five pre- and post essays, an updated copy of their summary matrix, as well as a final summative reflective essay and a separate recommendation from their GCSP Mentor. The Steering Committee will review all applications and determine final approval. Approved students must make a presentation for the Steering Committee and all students enrolled in the program at the Annual GCSP Celebration before final approval is given.

Each April, the GCSP Steering Committee will anonymously electronically survey all GCSP Mentors and students to assess alignment of the program with the goals, objectives and context of the institution, as well as GCSP program requirements. Opportunities for improvement, etc., will be specifically solicited as part of this assessment. The Steering Committee will review the responses and make adjustments, as deemed appropriate. Note that a GCSP Student Advisory Committee (the majority of whom attended the 2017 Grand Challenge Summit in Washington, DC) assisted in the development of this proposal.

Institutional GCSP Governance and Sustainability

The GCSP Director will be Martha Bizzell, Student Success Specialist for the School of Engineering. Ms. Bizzell has a B.S. in Industrial Engineering and a master's degree in Education, with industry experience, as well as experience running museum STEM exhibits, engineering summer camps, and K12 classroom experience.

The GCSP Steering Committee will consist of the GCSP Director, the Dean (a former GCSP Director and Chair of the national NAE GCSP Steering Committee for seven years), and a Faculty Representative from each of the three concentration areas (mechanical, chemical and

electrical). Faculty Representatives will be rotating positions selected to serve a three-year term, to ensure that all faculty have a baseline understanding of the GCSP. Participating students will provide input on an annual basis through the anonymous annual GCSP survey, as outlined above.

The GCSP Director will work with our GCSP Scholars and ENGR 100 instructors to recruit students for the program (the members of our GCSP Student Advisory Committee members will fulfill the role of the GCSP Scholars with respect to assisting with recruiting in the first year when we have no prior Scholars in the program). Note that all engineering majors are required to take ENGR 100 their first semester on campus. The Director will call the Steering Committee meetings each semester, lead review of student applications and final approval of program completion (both to be reviewed by the entire Steering Committee), oversee the Annual GCSP Celebration event where students who have completed the program will give a presentation on their experiences and be recognized, and lead the annual program assessment survey. The Director, initially together with the Dean, will train GCSP faculty Mentors prior to the start of their service on the GCSP Steering Committee and mentor them, as needed. The Director will also submit the names of GC Scholars and descriptions of their accomplishments as part of the annual report submitted to the NAE.

The Dean will oversee fundraising and solicitation of other resources for programmatic support. The Dean will support the program (to include attendance of one or more representatives at the annual GCSP meeting, support for on-campus GCSP events and meetings, marketing materials, etc.) from the Administrative Program Budget.

Mentorship for GCSP Faculty and Students

The GCSP Steering Committee members will serve as GCSP Mentors (with a maximum of 60 students in the program, this works out to no more than 10 mentees per mentor, which is a reasonable load). Each student will meet with their GCSP Mentor during the Advising Period each semester to support their development as a GC Scholar, to guide their progress, and to ensure thematic continuity and connectivity. The Mentor will collect, review and forward applications, pre- and post-essays, and final program approval requests to the GCSP Director.

As noted above, the Director, initially together with the Dean, will train all GCSP faculty Mentors prior to the start of their service on the GCSP Steering Committee and mentor them, as needed.

Student Recognition

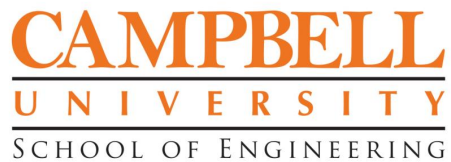
Students who successfully complete the GCSP requirements will receive a letter of recognition from the President of the National Academy of Engineering as a Grand Challenges Scholar and be included in the annual NAE Grand Challenges Scholar press release and web listing of all scholars. They will be recognized at the university Annual GCSP Celebration (to include a reception), featured in a university press release, and receive a medallion. The university does not permit students to wear any items with their regalia at graduation. The School of

Engineering, if approved, will seek to obtain permission to include a GCSP designation on the student's transcript.

Unique Aspects

Campbell students will be partnering with first-year engineering, capstone design, the campus Global Engagement Program, the Lundy-Fetterman School of Business and more. In addition, Campbell has a long-term relationship with the Algernon Sydney Sullivan Foundation, which is focused on social entrepreneurship. In fact, Campbell serves as a Sullivan Hub School. In addition, Campbell has a new strategic plan initiative focused on economic and community development (which is being led by the Dean of Engineering). Therefore, Campbell GCSP students have the opportunity to engage in entrepreneurship activities and projects sponsored by these groups, which include the semi-annual *Campbell Talks!* Lecture series, the annual *Ignite Retreat!* through the Sullivan Foundation, and Campbell's Social Entrepreneurship Club, also affiliated with the campus' Sullivan efforts. In addition, Campbell has permanent space at HQ Raleigh, an entrepreneurial co-working space with over 150 members, which provides students with access to entrepreneurship workshops, activities (like Hack-a-thons), and more. Campbell's Medical School, Doctor of Physical Therapy Program and School of Pharmacy all provide opportunities for students to partner on projects and global internship experiences that serve disadvantaged communities. Additional service opportunities exist in rural North Carolina through the School of Engineering's many partnerships with non-profit K12-serving organizations and the School's requirement that students complete 20-30 hours of service outside of class during their freshman year (50 hours total of professional development and service is required freshman year, a minimum of 20 hours of each with the remaining 10 hours fulfilled by any combination of approved professional development and service experiences). Campbell's new Honors Program will provide our GCSP students with unique courses and experience that may satisfy the multidisciplinary or multicultural competencies.

Appendix A



Campbell University Grand Challenge Scholars Program Application Form

Name: _____

Major/Concentration: _____

Email Address: _____

Anticipated Graduation Date: _____

Selected Grand Challenge Thematic Area/Grand Challenge(s): _____

Essay – Your essay must clearly demonstrate both your awareness of and eagerness to address the social and global issues embodied in the NAE Grand Challenges, as well as your commitment to addressing your selected Grand Challenge Thematic Area/Grand Challenges. This is an important part of your application.

(Essay, continued)

(over)

Appendix B



Campbell University Grand Challenge Scholars Program Summary Matrix

Name: _____

Selected Grand Challenge Thematic Area/Grand Challenge(s): _____

For each competency, below, select one option for each row to indicate how you plan to fulfill the associated competency requirement: (note – full details on all requirement options are listed in the CU School of Engineering GCSP Operational Document)

Competencies					
Talent	Capstone Design Project	Summer REU Project	Honors Thesis Project	Faculty Research Project	National Competition Team Project
Multicultural	Study Abroad Internship	Study Abroad Course		Global Research Project	
Multidisciplinary	First-Year Design Sequence				
Business/Entrepreneurship	CU Soup Idea Pitch Competition	Three Workshops at HQ Raleigh or HQ Fuquay	Intellectual Property Application	Approved Course in Entrepreneurship	
Social Consciousness	FIRST Lego League Mentor	Tutor or SI Leader	EAN Member for 1 year +10 K12 Events		

Appendix C

Campbell University Grand Challenge Scholars Program Semester Check-Up Form

Semester: _____ GCSP Mentor: _____

Name: _____

Selected GC Thematic Area/GC(s): _____

Update progress for each competency below:

Talent Competency

Selected activity: _____

Pre-Essay Complete? _____ If not, due date? _____

Activity Complete? _____ If not, semester activity is planned? _____

Post-Essay Complete? _____ If not, due date? _____

Outstanding items?

Multicultural Competency

Selected activity: _____

Pre-Essay Complete? _____ If not, due date? _____

Activity Complete? _____ If not, semester activity is planned? _____

Post-Essay Complete? _____ If not, due date? _____

Outstanding items?

CU GCSP Semester Check-Up Form, Page 2

Multidisciplinary Competency

Pre-Essay Complete? _____ If not, due date? _____

Activity Complete? _____ If not, semester activity is planned? _____

Post-Essay Complete? _____ If not, due date? _____

Outstanding items?

Business/Entrepreneurship

Selected activity: _____

Pre-Essay Complete? _____ If not, due date? _____

Activity Complete? _____ If not, semester activity is planned? _____

Post-Essay Complete? _____ If not, due date? _____

Outstanding items?

Social Consciousness

Selected activity: _____

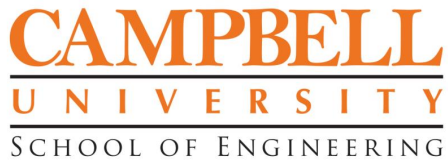
Pre-Essay Complete? _____ If not, due date? _____

Activity Complete? _____ If not, semester activity is planned? _____

Post-Essay Complete? _____ If not, due date? _____

Outstanding items?

Appendix D



Campbell University Grand Challenge Scholars Program Request for Review

Semester: _____ Graduation Date: _____

Name: _____

Selected GC Thematic Area/GC(s): _____

GCSP Mentor: _____

I have completed the required activities in each of the five component areas of the GCSP. I have attached a copy of my updated summary matrix, my five pre-essays and my five post-essays (one, each, for the five competencies). I have attached a copy of my final summative reflective essay on my GCSP experience and requested a letter of recommendation from my GCSP Mentor be forwarded to the GCSP Director. I am hereby requesting that my portfolio of GCSP activities be reviewed for compliance and certification of program completion.

Signature: _____

Date: _____