

Score Sheet. 601.455/665 Homework #2 - Fall 2023

Name: _____; Email: _____

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- 1. (30 points)
 - A. (5 points) _____
 - B. (10 Points) _____
 - C. (15 points) _____
- 2. (50 points)
 - A. (20 points) _____
 - B. (20 points) _____
 - C. (10 points) _____
- 3. (20 points)
 - A. (10 points) _____
 - B. (5 points) _____
 - C. (5 points) _____
- TOTAL (100 points) _____

I/we worked alone on this assignment and followed all other guidelines:

signature date

signature date

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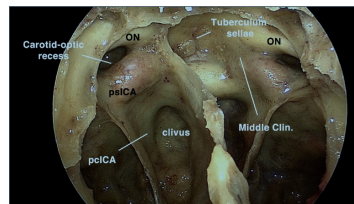
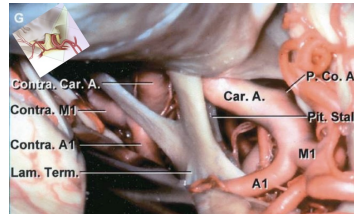
601.455/655 Computer Integrated Surgery I – Fall 2023



Scenario: Neurosurgery

In this assignment, you will be asked to a neurosurgery procedure. In particular, we would like you to select one if the procedures that Dr. Porras discussed for accessing deep brain structures in the skull base or ventricles, analyze the procedure from multiple viewpoints, and propose a technical means for improving some aspect of the selected procedure.

In addition to the reference materials provided on the course web site and the lecture material from Dr. Porras, you are encouraged to use other external references from the web or library. However, you should cite any materials that you use.



Images: Dr. Jose Porras' lecture of 2023-10-10

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Question 1 – Analysis of existing procedure

- A. Describe one particular surgical procedure or task for accessing deep brain structures in the skull base or ventricles, based on Dr. Porras' Guest Lecture from October 10. What is the clinical problem? Describe briefly how it is done now.
- B. Develop an outline for evaluating this procedure, including such factors as "cost", "safety", "effectiveness", "accuracy", "time", etc. For each such criterion, include:
 - Short definition or explanation of the criterion
 - Short discussion of how that criterion should be assessed (e.g., units of measure, means of gathering information)
 - Short discussion of how important each criterion is to each relevant group affected (patient, surgeon, hospital administrator, insurance company, employer, etc.)
- C. Use this outline to evaluate the existing method using these criteria



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Question 2 – Identifying alternatives

- A. Sketch an alternative approach using computer assistance to enhance this procedure. Do not write a book. I am looking for 1-2 pages maximum, possibly with a sketch or two.
- B. Sketch a second, distinct approach using computer assistance, with the same sort of information and discussion included in Part 2.A.
- C. Develop an outline evaluating the two approaches using the criteria developed in Question 1. Your analysis should compare your approaches to each other and to existing manual practice.

NOTE: Your alternatives may either involve significant improvements to existing robotic systems and methods or may suggest other, possibly non-robotic, systems and methods.



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Question 3 – Fleshing out the preferred embodiment

- A. Based upon your analysis in Question 2, select one of your proposed system solutions for further design evaluation. For this design, provide an additional 2-3 pages total (discussion + sketches) outlining the technical approach. Your discussion should clearly define
- Preoperative, intraoperative, and postoperative information needed.
 - How this information will be obtained.
 - Important components and human interfaces.
 - Key coordinate systems and their relationship to each other
 - What components need to be developed.
 - What components (if any) need to be “invented”
- B. Summarize the step-by-step procedural flow for your solution. What will the surgeon or other members of the team do at each step? What information will be needed at each step? How will this be obtained?
- C. Discuss the steps, timeline, and estimated resource requirements to implement your solution for clinical use



Important NOTE

- There is no single “right” answer to these questions, and I am well aware that people may not have either the experience or the knowledge to make highly credible estimates of things like schedules and costs. The purpose of the exercise is to get you to think.
- In grading the answers, we will be looking more at your reasoning and your approach to the problem than at the specific “correctness” of any technical solutions you come up with.
- At the same time, do try to keep sight of the specific goals of the application, and don’t simply resort to science fiction. An answer proposing well trained termites is not likely to score very well.

