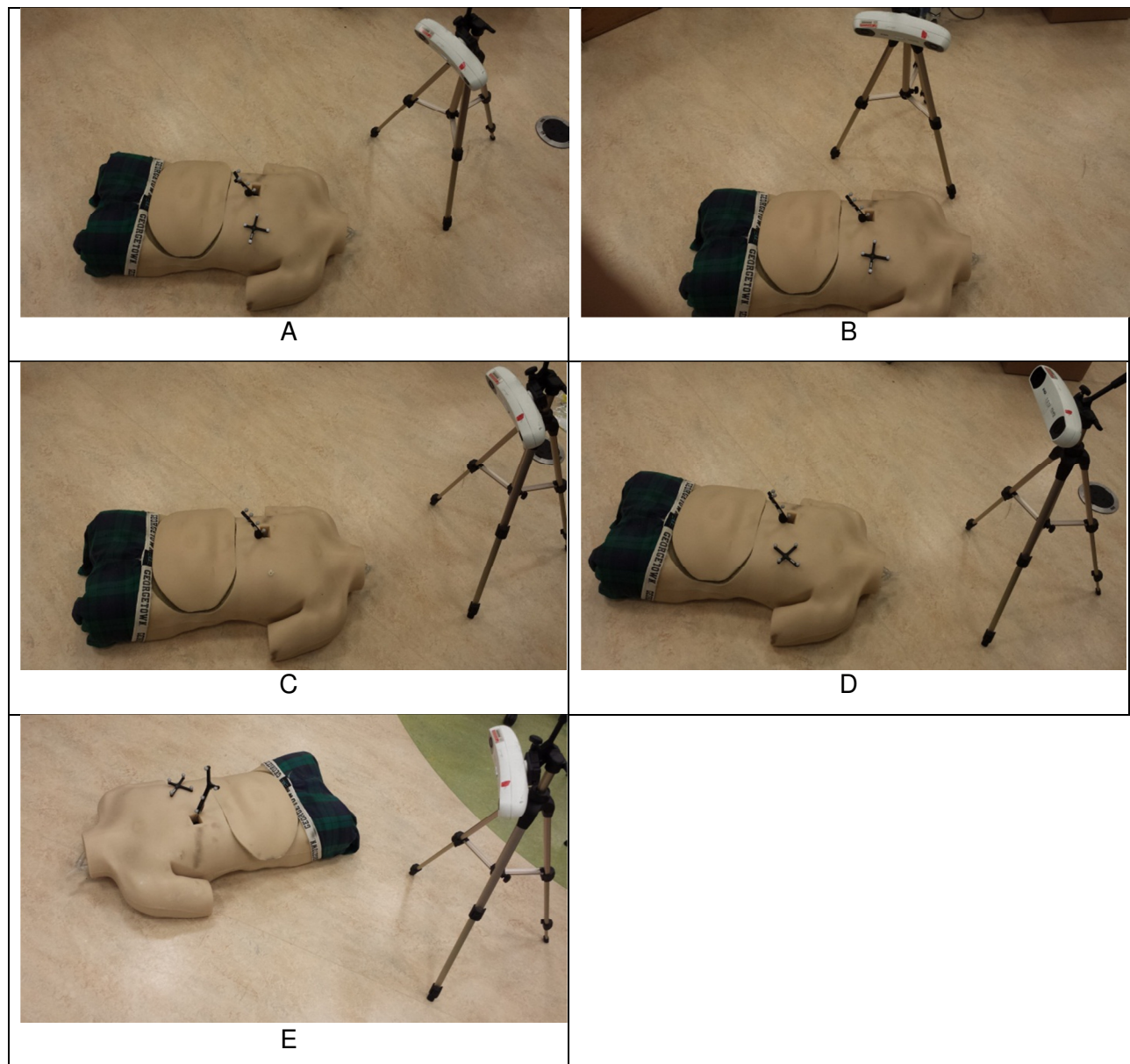
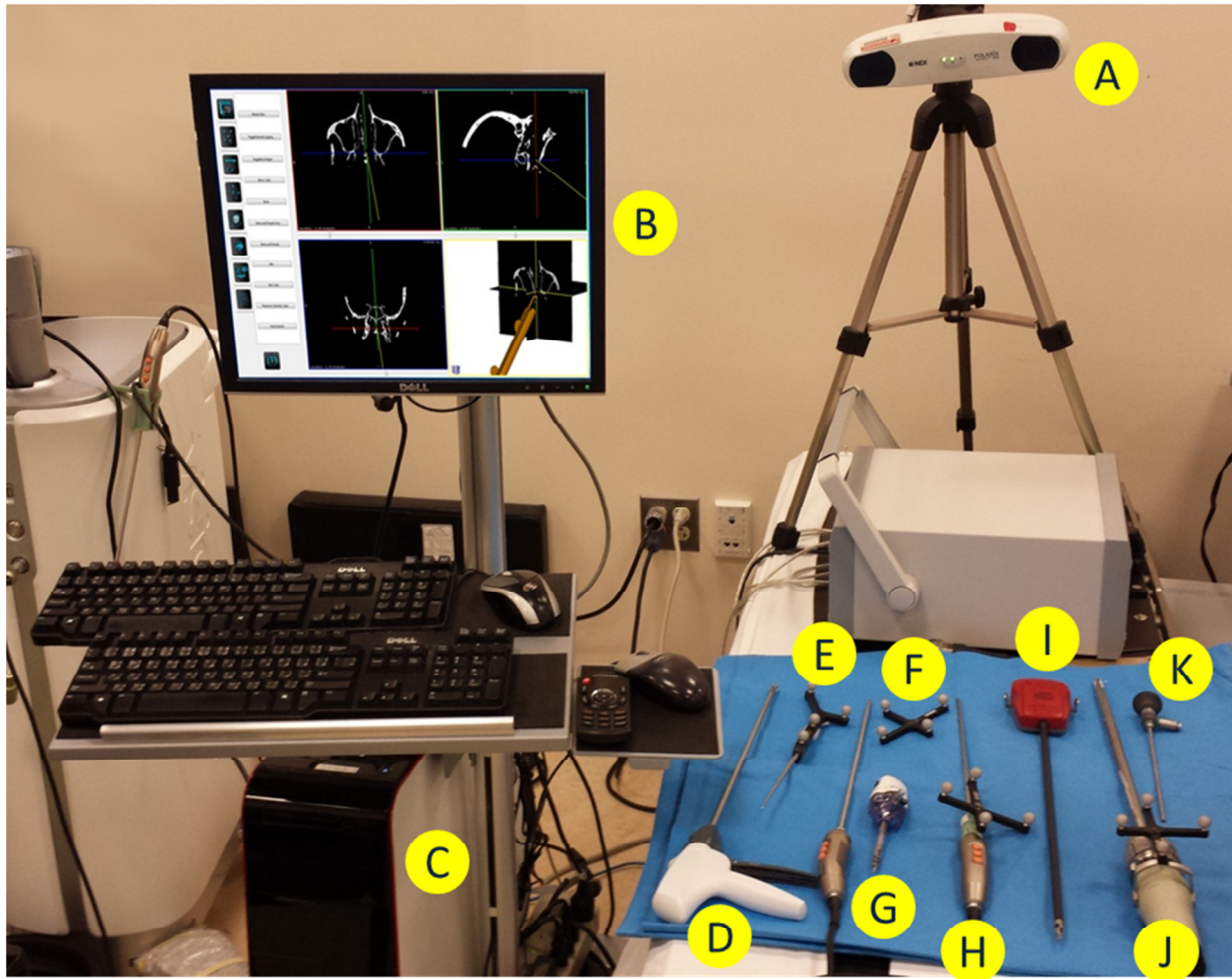


Test Your Knowledge

1. **[3 Points]** The tracking system's camera can be placed:
 - a. Anywhere in the room.
 - b. Behind the surgeon facing the patient.
 - c. In front of the surgeon facing the patient.
 - d. Facing the surgeon.
2. **[3 Points]** Which of the following setups are appropriate for image-guided navigation?



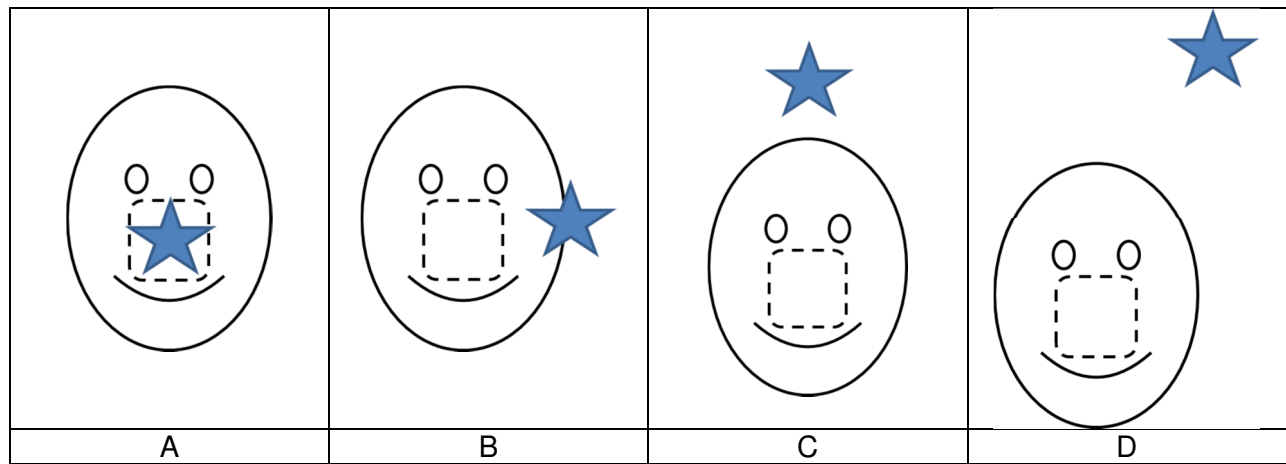
3. **[3 Points]** Which of the following components are part of the navigation system:



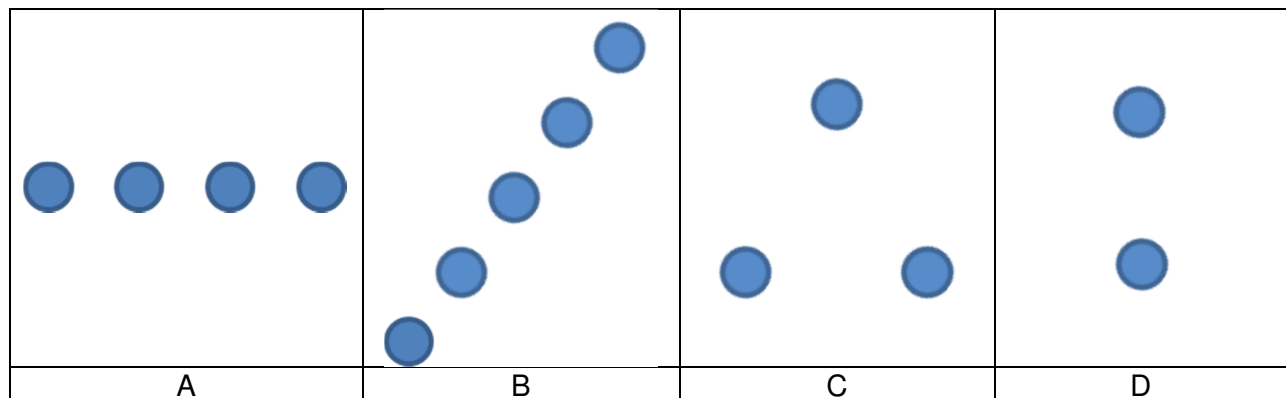
4. **[3 Points]** Which of the following components can we freely move after registration (assuming line-of-sight condition met)?

- a. Patient (DRF fixed to the patient)
- b. Patient (DRF fixed to the OR-table)
- c. Tracked pointer
- d. Tracking system's camera

5. **[3 Points]** Which of the following setups will provide the most accurate guidance for ENT (patient's head is fixed to the table)? The star marks the position of the DRF and the dotted line denotes the intervention site.



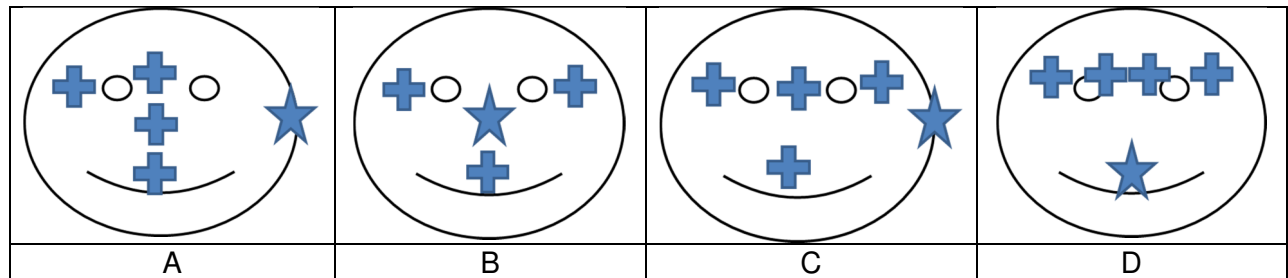
6. **[3 Points]** Which of the following fiducial configurations can we use for registration?



7. **[3 Points]** What is the minimal number of fiducials we can use for registration?

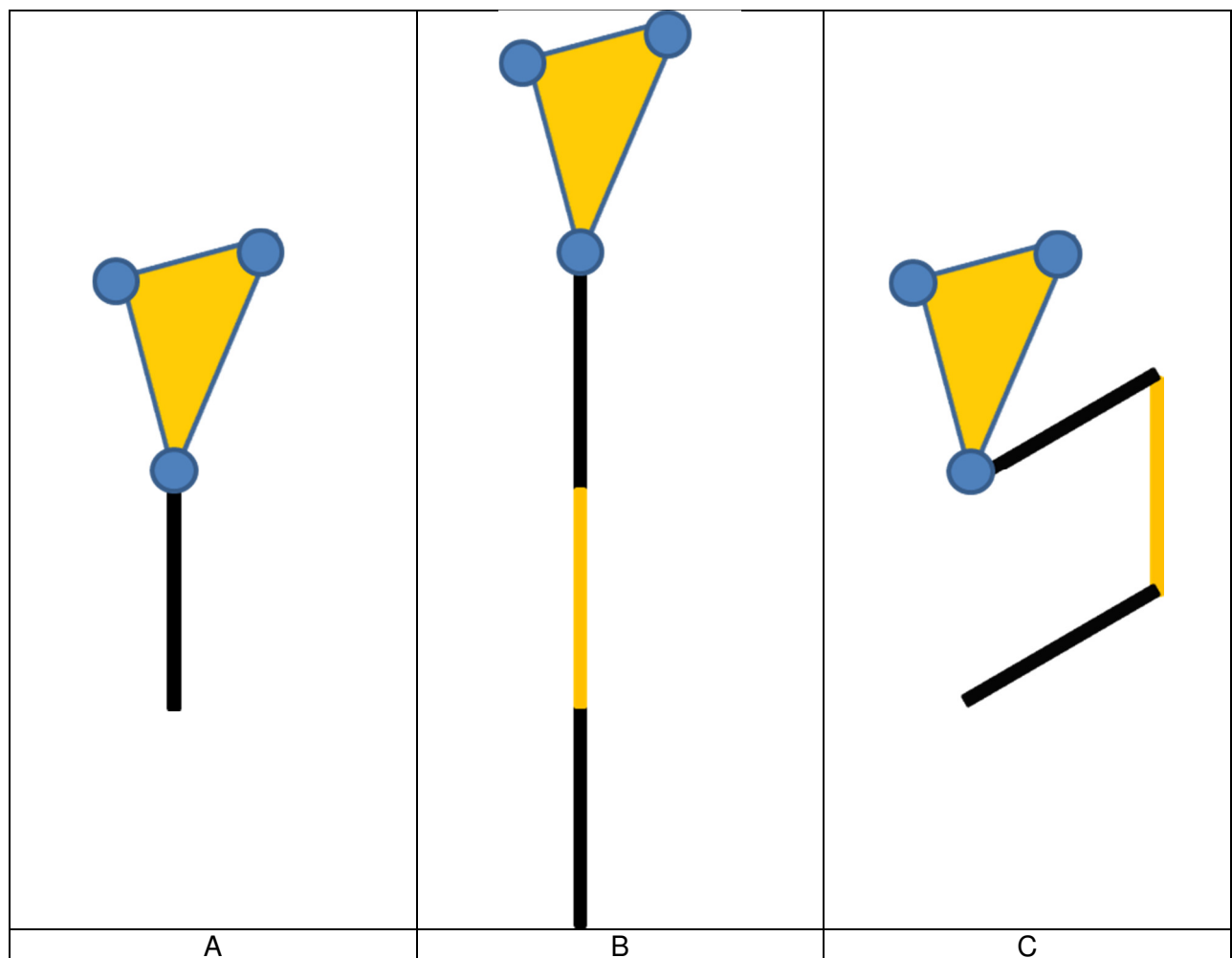
- 2
- 3
- 4
- 5

8. **[3 Points]** Which of the following fiducial configurations (crosses) will provide the most accurate registration when the intervention site is at the position marked by the star?



9. **[3 Points]** Which of the following tools (probe tip) will be tracked with the highest accuracy?

- B
- A
- A and B
- A and C



10. **[3 Points]** The navigation system reported the following FRE numbers for different registrations:

A: 2.05 mm,
B: 2.1 mm,
C: 5.0 mm,
D: 7.0 mm.

Which registration will provide the most accurate navigation guidance?

- a. A and B
- b. C
- c. D
- d. Don't know

11. **[3 Points]** The navigation system reported the following numbers for different registrations:

A: 2.05 mm,
B: 2.1 mm,
C: 5.0 mm,
D: 7.0 mm.

Which registration will provide the most accurate navigation guidance?

- a. A and B
- b. C
- c. D
- d. Don't know

12. **[3 Points]** The navigation system reported the following expected TRE numbers for different registrations:

A: 2.05 mm,
B: 2.1 mm,
C: 5.0 mm,
D: 7.0 mm.

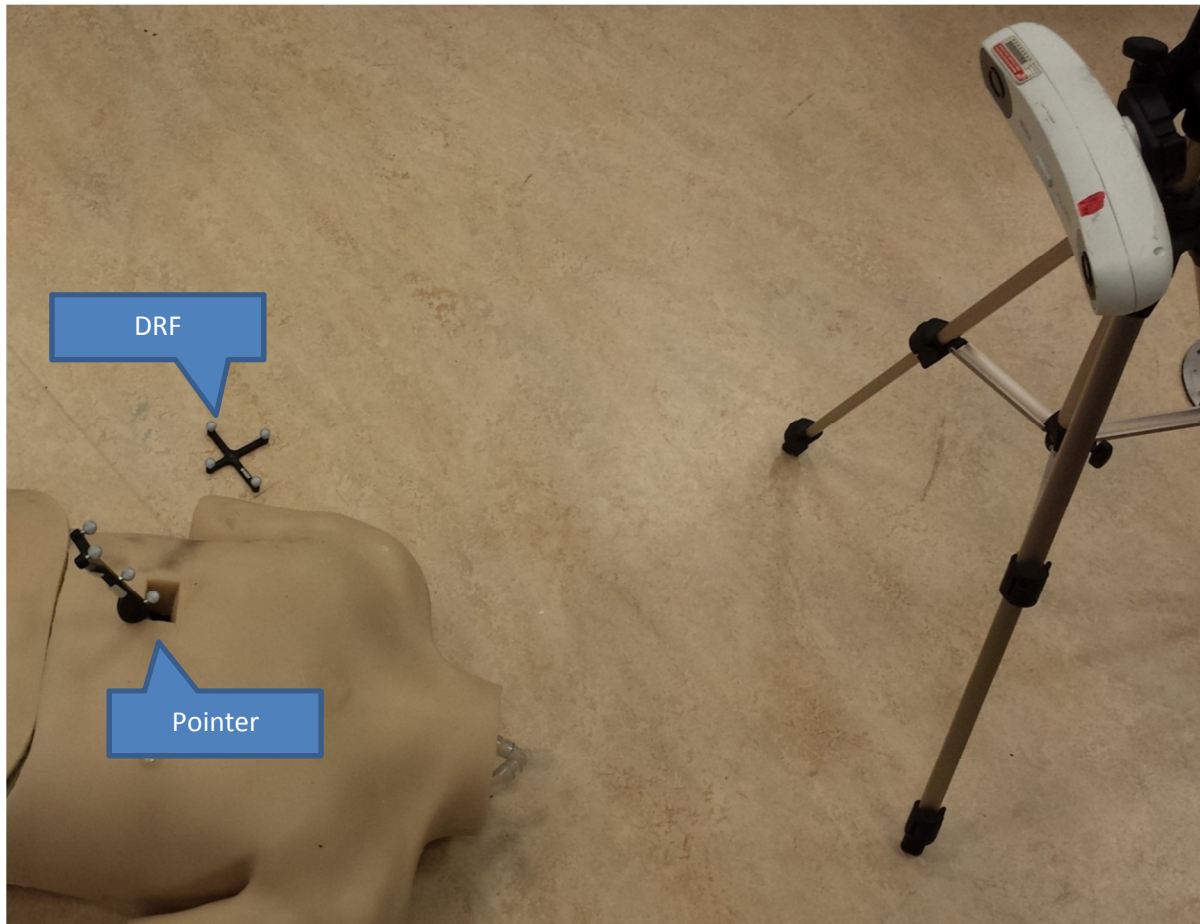
Which registration will provide the most accurate navigation guidance?

- a. A
- b. B and C
- c. D
- d. Don't know

13. **[8 Points]** Imagine a clinical scenario where a patient's head is fixed to the OR-table. A DRF fixed to a mechanical arm is positioned near the patient's head and locked. After this initial setup a registration is performed and you are ready to start navigation. However, the nurse realizes that the surgical site has not been prepped. You pause with navigation while the nurse prepares and sterilizes the patient. While sterilizing, she/he bumps into the mechanical arm and dislodges it. She/he corrects this by readjusting the mechanical arm.

What would you do in this scenario? Explain your reasoning.

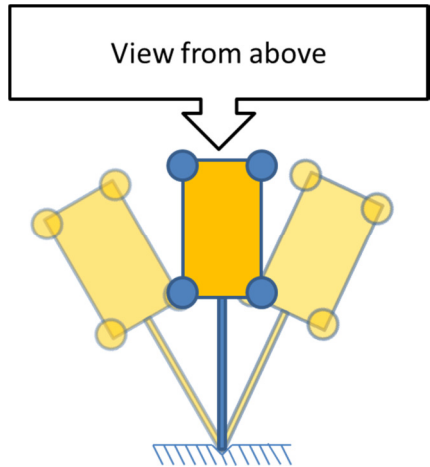
14. [8 Points] What is problematic with the following setup?



15. **[8 Points]** The navigation system reported an error of 0.05mm, in this case, do you need to validate the registration by touching several anatomical landmarks, or do you start navigating immediately?

16. **[8 Points]** You attach a rigid body to a flexible endoscope and want to track it with an optical tracking system. What should you pay attention to in this setup?

17. [3 Points] Which of the following pivoting motions will yield the most accurate calibration?



A	B	C	D

18. **[12 Points]** Number the following actions in their correct chronological order.

____ Registration

____ Pointer calibration

____ Validating registration

____ Target point definition in CT-image

____ Localization of landmarks on the patient with pointer

____ Definition of fiducials in CT-image

____ Start navigation

Explain why one action precedes the other.

19. **[3 Points]** Which of the following tracking system is appropriate for tracking a tool that bends and is inserted into the patient:

- a. Optical tracking system
- b. Electromagnetic tracking system
- c. Mechanical arm
- d. All of the above

20. **[5 Points]** What are the disadvantages of optical tracking systems?

21. **[9 Points]** After setup and registration you check the accuracy of the navigation system using several anatomical landmarks. You place the pointer tool on the tip of the nose and observe an offset of a couple of centimeters. Localizing other anatomical landmarks, you realize that the offset is almost the same, i.e. the magnitude of the error and direction of the error behave similarly. What would you do to decrease the error in this scenario? Explain your reasoning.
