1. State the specific location of the following: (3)
   a) cell bodies for sensory axons that carry pain from a cut on the back of the scalp
   b) cell bodies of motor axons that terminate on cremaster muscle cells
   c) cell bodies of sensory axons carrying the discomfort of a full bladder
   d) cell bodies of motor axons that terminate on coronary arteries and cause them to dilate
   e) cell bodies of sensory axons that carry pain arising from ischemia of the descending colon
   f) cell bodies of sensory axons that carry pain from the central portion of diaphragmatic parietal pleura

2. A major concern following a diagnosis of cancer is whether the cancer has spread beyond the primary tumor. With this in mind, explain why the prognosis is poor in the following situations: (2)
   a) Cancer cells are detected in Virchow’s node in a woman with ovarian cancer
   b) The primary tumor of a man’s lung cancer occurred in his left lower lobe

3. Trace the blood supply from the aorta to the interventricular septum in a right coronary dominant heart: (2)

4. In regard to direct and indirect inguinal hernias: (2)
   a) Identify where the hernia pushes through the abdominal wall relative to the inferior epigastric vessels for each.
   b) Which is more likely to enter into the scrotum in males?
   c) Why is one more common in premature than full term infant boys?
   d) Which one pushes through the abdominal wall in the region of Hesselbach’s triangle?
5. In order to eliminate the pain of labor and delivery, an obstetrician plans to perform an epidural block. Where does she direct her needle, and how does she identify this spot? (2)

Which spinal nerves must be bathed in anesthetic if she is to be successful?

6. A surgeon wishes to gain access to the lesser sac in order to remove a pancreatic tumor. For each of the following potential entry points into the lesser sac, provide the requested information: (6)

Epiploic foramen (Foramen of Winslow)
  a) Where is it located?
  b) Is it a good choice? Why or why not?

Lesser omentum
  a) What is it and where is it located?
  b) Is it a good choice? Why or why not?

Gastrocolic ligament
  a) What is it and where is it located?
  b) Is it a good choice? Why or why not?

7. Below is a list of surface anatomy descriptions of places where you might place a stethoscope to hear different thoracic visceral structures. For each blank, enter the letter corresponding to the site where you should listen to the named structure. (2)

A. at the sternal end of the right 2nd intercostal space
B. at the sternal end of the right 3rd intercostal space
C. at the sternal end of the left 2nd intercostal space
D. at the sternal end of the left 3rd intercostal space
E. anterior chest between 4th-6th costal cartilage
F. anterior chest above 4th costal cartilage
G. in the 5th intercostal space about a hands-breadth to left of the midline
H. in the 6th intercostal space about a hands-breadth to left of the midline

I. above xiphisternal joint
J. above midpoint of clavicle
K. above medial 3rd of the clavicle
L. midaxillary line above 3rd rib
M. midaxillary line above 5th rib
N. medial to inferior angle of scapula
O. lateral to inferior angle of scapula

____ apical segment of upper lobe of a lung
____ middle lobe of the right lung
____ anterior segment of upper lobe of a lung
____ lower lobe of a lung
____ tricuspid valve
____ mitral (bicuspid) valve
____ pulmonary valve
____ aortic valve
8. A young man has been suffering with vague abdominal discomfort for several hours, but when he starts to also feel sharp periumbilical pain, he decides to go to the emergency room. While in the waiting room, he begins to feel sharp pain in the lower right side of his abdomen. The ER doctor diagnoses appendicitis. For each of his symptoms, identify the type of pain he was experiencing and how it is related to his appendicitis.

   His initial symptom of vague abdominal discomfort:

   The sharp pain near his umbilicus:

   The sharp pain in the lower right side of his abdomen:

9. When examining a child’s chest X-ray, the radiologist notices notching of the inferior border of the child’s ribs. He suspects the child has an aortic coarctation. Explain his reasoning with reference to anatomy.

10. For each region of the vertebral column listed below, name and describe its normal curvature, and state when it first arises during development.

   a) cervical region:

   b) thoracic region:

   c) lumbar region:

11. During laparoscopic abdominal surgery, name two characteristics you could use to distinguish colon from small intestine.

   Name two characteristics you could use to distinguish jejunum from ileum.

12. What spinal nerve would most likely be affected by herniation of the following intervertebral disks?

   a) C2/C3
   b) C7/T1
   c) L4/L5
   d) L5/S1
13. What is the effect of the sympathetic nervous system on:
   (2.5)
   a) heart rate
   b) the pyloric sphincter
   c) male reproductive function
   d) adrenal medulla
   e) external anal sphincter

14. For each of the following nerves, circle the name if it contains preganglionic visceral motor axons, and underline the name if it contains visceral sensory axons. (3)
   a) a dorsal ramus of a thoracic spinal nerve
   b) a ventral ramus of a thoracic spinal nerve
   c) a white ramus communicans
   d) a gray ramus communicans
   e) a sympathetic cardiac nerve
   f) a thoracic splanchnic nerve
   g) a pelvic splanchnic nerve
   h) a cutaneous nerve
   i) the anterior vagal trunk

15. Loss of the blood supply to a structure commonly leads to tissue death (necrosis). Give an anatomic explanation for why the following did not have this result: (2)
   a) A patient’s inferior mesenteric artery was tied off but her descending colon did not die
   b) A patient’s middle colic artery was tied off but his transverse colon did not die
   c) A patient’s right hepatic artery was tied off but his quadrate lobe did not die
   d) A patient’s proper hepatic artery was tied off but her liver did not die

16. To treat a case of esophageal carcinoma, a surgeon plans to perform an esophagectomy (removal of the esophagus). What major nerves will necessarily be sacrificed during this procedure? (1.5)

To make the loss of these nerves compatible with life, what other structure must be surgically altered and why?
17. Blood leaking from an abdominal aortic aneurysm spreads throughout the retroperitoneal space. Why does the blood from a lacerated kidney not spread throughout the retroperitoneal space? (1)

18. Some surgeries have unintended consequences. Give an anatomical explanation for the following: (3)
   a) Hoarseness can follow surgical repair of an aortic arch aneurysm
   b) An older woman may experience premature onset of menopause following a hysterectomy even though her ovaries were not removed
   c) Surgical removal of the prostate can result in male impotence

19. Name the first major group(s) of lymph nodes to which cancer from the following structures will metastasize: (3)
   a) stomach
   b) ascending colon
   c) labium majus
   d) testis
   e) middle lobe of right lung
   f) uterus

20. A boy attempting to ride his bicycle while standing on the seat falls and lands with his legs straddling the upper bar of the bike frame. The next day he is alarmed to find his scrotum and penile shaft are swollen with fluid. (3)
   Where did this fluid most likely come from?
   Where did the fluid initially accumulate before reaching his penis and scrotum?

   Explain with reference to anatomy how the fluid came to be in his scrotum and penis.
21. Identify the structures that have the following relationships to the arch of the aorta: (2)
   a) Passing superoinferiorly to the left of the arch ________________________ & ______________________
   b) Passing superoinferiorly to the right of the arch ________________________ & ______________________
   c) Passing horizontally inferior to the arch ________________________, _________________________ & _________________________
   d) Is located anterior to the arch ________________________________

22. Explain with reference to anatomy how cirrhosis of the liver can result in esophageal varices. (1)

23. State the surface anatomy of the inferior border of the right lung. (2)

24. Why is cancer in the head of the pancreas often detected earlier than cancer in the body? (1)

25. Trace the path of normal lymphatic drainage of the right breast to the vascular system (you may use either clinical or anatomical nomenclature for naming nodes): (3)
26. Below are three MRA images from the same patient. The vertical line on the top image indicates the plane of the middle image. The vertical line on the middle image indicates the plane of the top image. The transverse lines on the top and middle images indicate the plane of the bottom image. Identify the labeled structures, stating side (L or R) where appropriate.

A: __________________________________________
B: __________________________________________
C: __________________________________________
D: __________________________________________
E: __________________________________________
F: __________________________________________
G: __________________________________________
H: __________________________________________
I: __________________________________________
J: __________________________________________
K: __________________________________________
L: __________________________________________
M: __________________________________________
N: __________________________________________
Below are three CT images of a woman with intravascular contrast. Identify the labeled structures, stating side (L or R) where appropriate.

A: ____________________________________
B: ____________________________________
C: ____________________________________
D: ____________________________________
E: ____________________________________
F: ____________________________________
G: ____________________________________
H: ____________________________________
I: ____________________________________
J: ____________________________________