Instructions: This exam is closed book, except for the "reference" booklet provided by your instructor. To receive full credit, you must show all of the work required obtaining the correct answers. No credit will be given for illegible/illogical work or for final answers that are not justified by the work shown. You must maintain at <u>least</u> three significant digits of accuracy for all of your calculations.

Assume an *ambient temperature of 30°C* if needed for all problems <u>unless</u> stated otherwise.

Problem #1) A 3Φ, 208V branch circuit will be used to supply a 15kVA, non-continuous, 3Φ load. Assuming a 30°C ambient temperature and that no other current-carrying conductors will be run in the same conduit with this circuit, determine the **smallest size copper** and the **smallest size aluminum** conductors that can be used for this branch circuit.

Conductor Size (Cu.) = _____

Conductor Size (Al.) = _____

Problem #2) Given a load that draws 85A continuous current and up to 120A non-continuous current, determine the rating of the **smallest standard-size circuit breaker** that can be selected to properly protect the circuit supplying the load.

CB Rating = _____ **A**

Problem #3) The individual branch circuits that supply four (4) different single-phase loads are all run through the same conduit (raceway). The conductors utilized for the four branch circuits are all #4 AWG, copper, THHN conductors. Assuming a 35°C ambient temperature, determine the **maximum continuous current** that each individual branch circuit is able to supply to its load.

$I_{Load-Max(Continuous)} =$ _____ **A**

Problem #4) Given the L-shaped conductor having the dimensions shown in the figure below, determine the **cross-sectional area** of the conductor in circular mils.
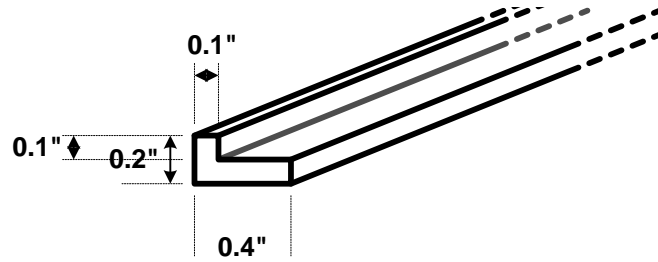
$$\textit{Cross-Sectional Area} = \underline{\hspace{3cm}} \textbf{ cmils}$$

Problem #5) Given a 225kVA, 24,940V–480V, Δ-Y, 3Φ transformer, determine the rated (full-load) current for the transformer's LV winding.

$$I_{rated(LV)} = \underline{\hspace{3cm}} \textbf{ amps}$$

Problem #6) Compared to a single 500kcmil, aluminum conductor,

Two 250kcmil, aluminum conductors connected in parallel will have:

- a total (combined) conductive cross-sectional area that is _____ the cross-sectional area of the single 500kcmil conductor.

- a total (combined) ampacity that is _____ the ampacity of the single 500kcmil conductor.

- an effective (combined) DC resistance that is _____ the resistance of the single conductor (rounded to three significant digits)

Write either "**greater than**", "**less than**", or "**equal to**" in each of the blanks provided above in order to make each of the statements true.

Multiple Choice – Write the letter that corresponds to the correct response for each of the following statements in the blank space preceding each statement.

_____ Given a 300kcmil conductor utilized within a distribution system, the conductor will most likely be **composed** of:
A) either <u>stranded copper</u> or <u>stranded aluminum</u> wire.
B) either <u>stranded copper</u> or <u>solid aluminum</u> wire.
C) either <u>solid copper</u> or <u>stranded aluminum</u> wire.
D) either <u>solid copper</u> or <u>solid aluminum</u> wire.

_____ Given a 3Φ, 4-wire circuit having a phase-voltage magnitude of 780V, the **line-voltage magnitude** of the circuit will be closest to:
    A) 450V
    B) 552V
    C) 1,103V
    D) 1,351V

_____ Given a standard **100A circuit breaker** that is protecting a circuit:
    A) the circuit breaker should never trip if no more than 50A flows continuously in the circuit
    B) the circuit breaker may trip if 90A flows continuously in the circuit
    C) the circuit breaker will trip if 110A flows continuously in the circuit
    D) All of the above statements (A-C) are true
    E) None of the above statements (A-D) are true

_____ The "**Interrupting Rating**" of a Circuit Breaker (CB) defines:
    A) the minimum line current magnitude that will cause the CB to trip
    B) the maximum line current magnitude that will cause the CB to trip
    C) the maximum line current magnitude that the CB can safely interrupt
    D) the line current magnitude, above which, will cause the CB to trip instantaneously

_____ A "**Branch Circuit**" is best defined as:
    A) the circuit conductors between the final overcurrent protection device and the load outlet
    B) a circuit that supplies only a single (individual) load.
    C) a circuit from which multiple individual load circuits can be supplied.
    D) a circuit that is protected by a circuit breaker (and not by a fuse).

_____ The **purpose** of the over-current protection devices (circuit breakers and fuses) used within an electrical distribution system is to:
    A) protect the utilization equipment (loads) connected to the distribution system during the occurrence of an over-current
    B) protect the circuit conductors and other components of the distribution system during the occurrence of an over-current
    C) make sure that the current flowing in any system circuit never rises above the current rating of the protective device
    D) is to limit the in-rush current flowing into a motor-load during startup.

_____ "**Feeders**" are best described as:
    A) the circuit conductors between the final overcurrent protection device and the load outlet
    B) the circuit conductors between the point-of service and the final overcurrent-protection device
    C) the circuit conductors that feed power from the utility's transmission-lines to the service-entrance of the distribution system
    D) the circuit conductors that supply the primary-windings of any system transformers

_____ A "**Disconnecting Means**" is best defined as:

    A) a device that allows a branch circuit to be disconnected from its load

    B) a device that automatically disconnects a load or a circuit from its source of power during overcurrent conditions

    C) a device that automatically disconnects a load or a circuit from its source of power during fault conditions

    D) a device that allows the conductors of a circuit to be arbitrarily disconnected from their source of power

_____ Given a conductor with an ampacity based on a 30°C ambient temperature and a 60°C operational temperature rating, **if the ambient temperature increases** to 36°C (assuming no other changes) then the effective (usable) ampacity of the conductor will:

    A) increase

    B) decrease

    C) remain the same

    D) any of the above (A-C) could happen

_____ Given a conductor with an ampacity based on a 30°C ambient temperature and a 60°C operational temperature rating, **if the operational temperature rating is increased** to 75°C (assuming no other changes) then the effective (usable) ampacity of the conductor will:

    A) increase

    B) decrease

    C) remain the same

    D) any of the above (A-C) could happen

True/False Statements – Specify whether each of the following statements is "TRUE" or "FALSE":

_____ The overcurrent protection device protecting a branch circuit should always be placed at end of the circuit conductors that is closest to the source of electric energy.

_____ The (trip) rating of a circuit breaker that is protecting a circuit must be greater than the ampacity of the conductors used in that circuit.

_____ An "overload" occurs in a circuit when more than the rated current is flowing along the normally-conductive path of the circuit.

_____ A three-phase, 208V, 3-wire distribution system can be used to supply single-phase loads at either 208V or 120V.

_____ Although "switchboards" and "panelboards" can both be used to serve the same purpose, switchboards are typically free-standing enclosures while panelboards are typically wall-mounted enclosures.

_____ The National Electric Code (NEC) is updated and a new revision is published on a 5-year basis.

_____ The ampacity of a conductor can be increased by switching from copper to aluminum without changing the conductor size.

Instructions: This exam is closed book, except for the "reference" booklet provided by your instructor. To receive full credit, you must show all of the work required obtaining the correct answers.

Assume an *ambient temperature of 30°C* if needed for all problems <u>unless</u> stated otherwise.

Problem #1) Given a raceway that contains 24 different single-phase circuits, each of which is composed of a pair of #6, THHN, copper conductors,

Determine the **ampacity** of the conductors (rounded to the nearest Amp) if the ambient temperature is 30°C.

Ampacity = _____ **A**

Problem #2) Given a load that draws 110A continuous current and up to 80A non-continuous current, determine the rating of the **smallest standard-size circuit breaker** that can be selected to properly protect the circuit supplying the load.

CB Rating = _____ **A**

Problem #3) Given a 3Φ branch circuit that is composed of three individual, 300 kcmil, THHN, copper conductors running through a dedicated raceway (i.e. – no other conductors in the raceway) with an ambient temperature of 42°C,

Determine the **ampacity** of the conductors (rounded to the nearest Amp).

Ampacity = _____ **A**

Problem #4) Given a 3Φ branch circuit that is composed of three individual, #6 AWG, THHN, aluminum conductors running through a dedicated raceway (i.e. – no other conductors in the raceway) with an ambient temperature of 30°C,

Determine the **maximum continuous load current** that can be supplied by the circuit.

$$I_{Load-Max(Continuous)} = \underline{\hspace{4cm}} \textbf{A}$$

Problem #5) Determine the **KVA rating** (rounded to the nearest Amp) of a 460V, 50A, 3Φ load.

$$S_{rated} = \underline{\hspace{4cm}} \textbf{KVA}$$

Problem #6) Determine the **rated phase-voltage** (rounded to the nearest Volt) of a 360V, 3Φ, 4-wire system.

$$V_{Phase(rated)} = \underline{\hspace{4cm}} \textbf{V}$$

Problem #7) Determine the **overall diameter, the cross-sectional area** (in cmils) and the **DC resistance** of a bare, 2/0 AWG, stranded, copper conductor at a temperature of 75°C.

$$diameter = \underline{\hspace{3cm}} \textbf{in}$$

$$area = \underline{\hspace{3cm}} \textbf{cmils}$$

$$R_{DC} = \underline{\hspace{3cm}} \textbf{Ω/kFT}$$

Multiple Choice – Write the letter that corresponds to the correct response for each statement.

_____ Given two conductors, one copper and the other aluminum, both having the same (AWG) size and length; compared to the aluminum conductor, **the copper conductor**:
   A) weighs less and has a lower resistance
   B) weighs more and has a lower resistance
   C) weighs less and has a higher resistance
   D) weighs more and has a higher resistance

_____ Given a standard **50A circuit breaker** that is protecting a circuit:
   A) the circuit breaker should never trip if less than 50A flows continuously in the circuit
   B) the circuit breaker may not trip if 60A flows continuously in the circuit
   C) the circuit breaker will trip if 30A flows continuously in the circuit
   D) All of the above statements (A-C) are true
   E) None of the above statements (A-D) are true

_____ The "**Interrupting Rating**" of a Circuit Breaker (CB) defines:
   A) the maximum line current magnitude that the CB can safely interrupt
   B) the maximum line current magnitude that will cause the CB to trip
   C) the minimum line current magnitude that will cause the CB to trip
   D) the line current magnitude, above which, will cause the CB to trip instantaneously

_____ A "**Branch Circuit**" is best defined as:
   A) a circuit that is protected by a circuit breaker (and not by a fuse).
   B) a circuit that supplies only a single (individual) load.
   C) a circuit that is supplying a single-phase load.
   D) the circuit conductors between the final overcurrent protection device and the load outlet.

_____ The **purpose** of the over-current protection devices (circuit breakers and fuses) used within an electrical distribution system is to:
   A) protect the utilization equipment (loads) connected to the distribution system during the occurrence of an over-current
   B) protect the circuit conductors and other components of the distribution system during the occurrence of an over-current
   C) make sure that the current flowing in any system circuit never rises above the current rating of the protective device
   D) is to limit the in-rush current flowing into a motor-load during startup.

_____ An "**Overload**" is best described as:
   A) any current that is larger than the rated current of a circuit.
   B) any current that is larger than the rated current of a circuit and flows along the circuit's normally-conductive path.
   C) any current that flows along a circuit's normally-conductive path due to a circuit fault.
   D) A load that draws too large of a voltage from the conductors of a circuit.

_____ A "**Disconnecting Means**" is best defined as:
   A) a device that allows a branch circuit to be disconnected from its load.
   B) a device that automatically disconnects a load or a circuit from its source of power during overcurrent conditions.
   C) a device that automatically disconnects a load or a circuit from its source of power during fault conditions.
   D) a device that allows a set of conductors to be arbitrarily disconnected from their source of power.

True/False Statements – Specify whether each of the following statements is "**TRUE**" or "**FALSE**":

_____ The overcurrent protection device protecting a branch circuit should always be placed at end of the circuit conductors that is closest to the source of electric energy.

_____ A three-phase, 208V, 3-wire distribution system can be used to supply single-phase loads, but only at 208V.

_____ The National Electric Code (NEC) is updated and a new revision is published on a 3-year basis.

_____ The ampacity of a conductor can be increased by switching from copper to aluminum without changing the conductor size.

Instructions: **Part "B" of this exam is composed of a set of "take-home" problems that must be completed individually, under "closed-book" conditions, with absolutely no assistance from any other person or resource except for the PowerPoint slides provided on the course website.**

Problem #8) Given a branch circuit that supplies a 3Φ, 460V, 225kVA continuous load, determine the **minimum-sized conductors** and the **smallest "standard-rating" circuit breaker** that can be used in the circuit if:
- THHN, copper conductors are used in the circuit,
- The conductors are run through a raceway that also contains the conductors from two additional circuits that supply loads equivalent to the one specified above, and
- The circuit is exposed to a 47°C ambient temperature.

Conductor Size = _____

CB Rating = _____ **A**

Problem #9) If the conductors selected in problem #8 are changed from copper to aluminum conductors that are the same size as the originally-selected copper conductors:

Determine the **kVA rating** of the largest 3Φ, 460V, continuous load that can now be supplied by the circuit.

Load kVA = _____ **kVA**

Sample Exam I – More Problems   **Print Name (Last Name First):** _____

Instructions: This exam is closed book, except for the "reference" booklet provided by your instructor. To receive full credit, you must show all of the work required obtaining the correct answers. No credit will be given for illegible/illogical work or for final answers that are not justified by the work shown. You must maintain at <u>least</u> three significant digits of accuracy for all of your calculations.

Assume an *ambient temperature of 30°C* if needed for all problems <u>unless</u> stated otherwise.

Problem #A) An unlabeled (bare) stranded wire is measured to have an overall diameter of $\frac{1}{3}$". Determine the size of the wire based on the standard AWG sizes.

Size = _____ AWG

Problem #B) A conductor has an outer-diameter of 318 mils. Determine the conductor diameter in inches.

Diameter = _____ inches

Problem #C) Given a three-wire, single-phase, 240V source used to supply a 240V dedicated branch circuit that serves an appliance rated at 6800VA;
Assuming that the appliance will operate as a continuous load:

a) Determine the **smallest, standard-sized circuit breaker** that can be used to protect this branch circuit.

CB rating = _____ A

b) Determine the **smallest size, THHN, copper conductor** that could be utilized for this branch circuit assuming a 60°C temperature rating, 30°C ambient temperature, and no more than three current-carrying conductors in the conduit.

Conductor Size = _____

c) Determine the **number of poles** for the circuit breaker used to protect this branch circuit.

One Pole / Two Poles / Three Poles

(Circle the correct answer)

Problem #D) Additional **True/False** Statements:

_____ **Branch circuits rated at greater than 50A** should only be used to supply non-lighting type outlet loads.

_____ The (trip) **rating of a circuit breaker** that is protecting a circuit must be greater than the ampacity of the conductors used in that circuit.

_____ The "I^2t" **(time) curve** for a fuse provides the user with a plot showing the number of times that a fuse is able to successfully interrupt a specific amount of current.

_____ A **feeder** consists of a set of conductors that are used to directly supply current to utilization equipment that is connected to a distribution system.

_____ An **adjustment factor** is applied to the ampacity of the conductors within a raceway only when six or more current-carrying conductors are contained within the raceway.

_____ "**Switchboards**" are used within distribution systems to supply only feeders and "**panelboards**" are used within distribution systems to supply only branch circuits.

_____ A "**service lateral**" is a feeder that interconnects switchboards on the same floor of a multi-floor (high-rise) facility.

The figure shown below depicts a 3Φ service transformer that feeds three identical branch circuits, each of which terminates in an outlet. Loads will be connected to **each** of the outlets, and **each load** is expected to draw a continuous line current of 90A.
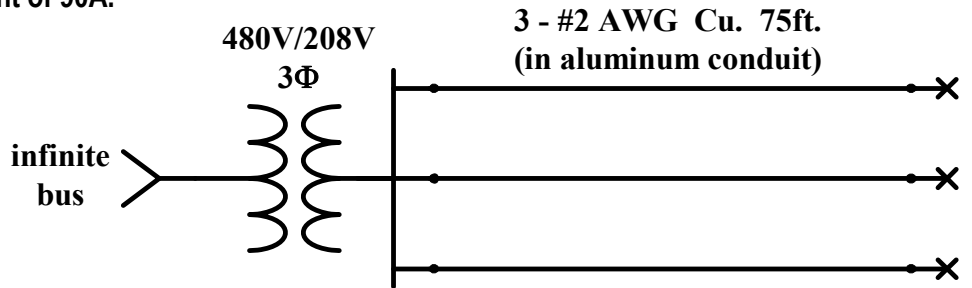
Problem #E) Given the system shown above:

a) Determine the kVA rating of the smallest, standard-size transformer that can be used in this system such that it is sized to handle the system shown along with the possible future expansion consisting of the addition of an identical 4th branch circuit and load.
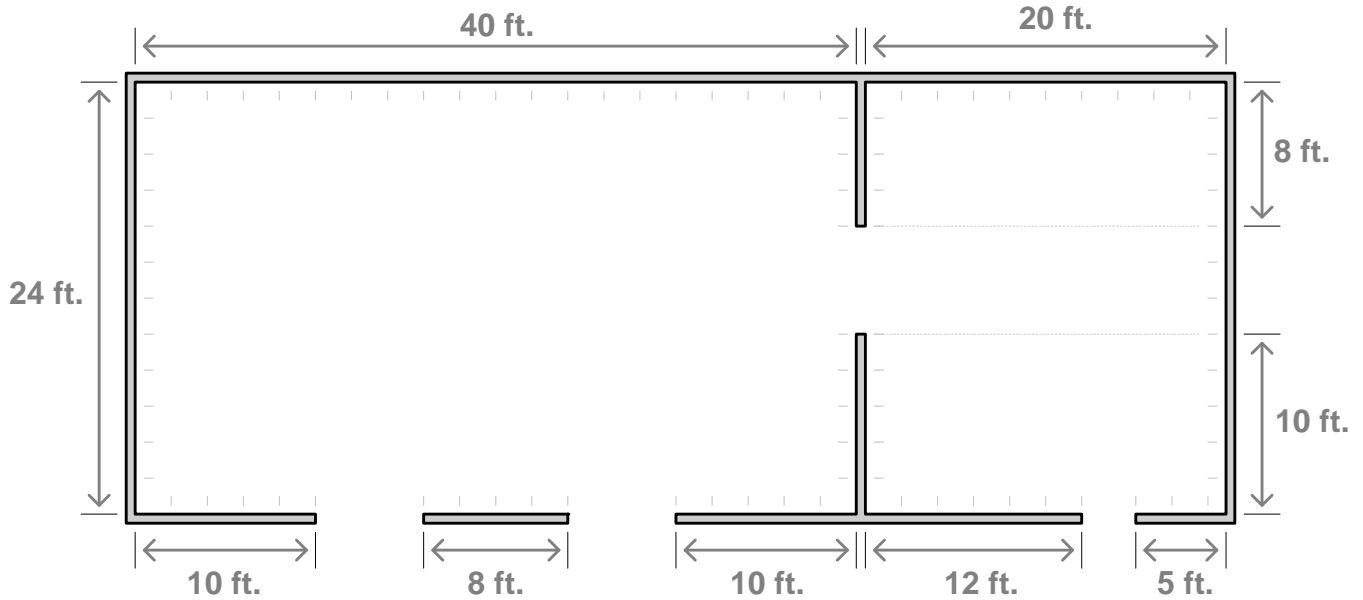
Transformer Rating = _____ **kVA**

b) Based on the kVA rating of the transformer that you choose in problem #2, determine the rated current (rounded to the nearest Amp) for both the transformer's HV and LV windings.

$I_{rated(HV)}$ = _____ **amps**

$I_{rated(LV)}$ = _____ **amps**

Problem #F) Given the following diagram that shows two rooms within a large, single-family dwelling;

a) Based on NEC requirements, determine the **minimum number of receptacle outlets** that must be placed within the two rooms **and** accurately **show the location of the outlets** on the diagram (using the appropriate symbols).

min. # receptacles = _____

b) Based on NEC requirements, determine the **minimum number of 15A circuits** that could be used to supply all of the receptacles in the two rooms if the minimum allowable load rating is assigned to each of the receptacles.

#15A circuits = _____

Instructions: This exam is closed book, except for the "reference" booklet provided by your instructor. To receive full credit, you must show all of the work required obtaining the correct answers. No credit will be given for illegible/illogical work or for final answers that are not justified by the work shown. You must maintain at least three significant digits of accuracy for all of your calculations.

Assume an ambient temperature of 30°C if needed for all problems underline stated otherwise.

Problem #1) Given a raceway that contains **three (3) separate three-phase (3Φ) branch circuits**, each of which is composed of a set of three **#8, THHN, copper conductors**,

Determine the **ampacity** of the circuit conductors.

Ampacity = _____ **A**

Problem #2) Given a 3Φ branch circuit that is composed of three individual, **300 kcmil, THHN, copper conductors** running through a dedicated raceway (i.e. – no other conductors in the raceway) with an **ambient temperature of 14°C**,

Determine the **ampacity** of the conductors.

Ampacity = _____ **A**

Problem #3) Given a branch circuit that supplies a 190A load, determine the sm**allest size Aluminum conductor** that can be utilized for the branch circuit and the rating of the **smallest standard-size circuit breaker** that can be selected to protect the circuit if the conductors are running through a dedicated raceway (i.e. – no other conductors in the raceway) and:
a) the circuit supplies a **non-continuous load**.
b) the circuit supplies a **continuous load**.

a) *Conductor Size* = _____

CB Rating = _____ **A**

b) *Conductor Size* = _____

CB Rating = _____ **A**

Problem #4) Given a 3Φ branch circuit that is composed of three individual, **#4 AWG, THHN, copper conductors** running through a raceway along with one other 3Φ branch circuit,

Determine the **maximum continuous load current** that can be supplied by the circuit assuming an **ambient temperature of 38°C**.

$$I_{Load-Max(Continuous)} = \underline{\hspace{4cm}} \text{ A}$$

Problem #5) Given a **140kVA, 460V, 3Φ load**, determine the current rating of the load.

$$I_{rated} = \underline{\hspace{4cm}} \text{ A}$$

Problem #6) Given the busbar having the dimensions shown in the figure below, determine the **cross-sectional area** of the busbar in circular mils.

3/16"

3/8"
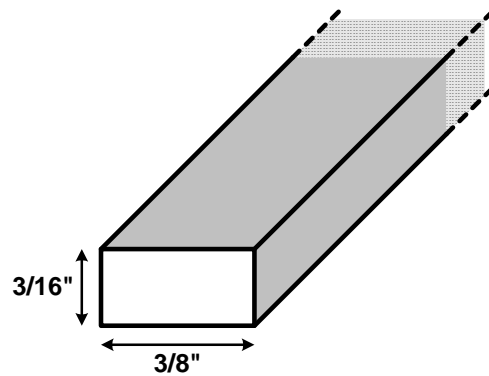
Cross-Sectional Area = \underline{\hspace{3cm}} **cmils**

Problem #7) Determine the (75°C) **DC resistance** of a **2/0 AWG, stranded, aluminum conductor** that is **250-feet** in length.

$$R_{DC} = \underline{\hspace{4cm}} \ \Omega$$

Problem #8) Determine the **cross-sectional area** in circular mils of a **2/0 AWG, stranded, aluminum conductor**.

Cross-Sectional Area = \underline{\hspace{3cm}} **cmils**

Multiple Choice – Write the letter that corresponds to the correct response for each of the following statements in the blank space preceding each statement.

_____ The NEC defines a "**Device**" as:
   A) a piece of equipment that utilizes electric energy for electromechanical, electronic, heating, lighting, or similar purpose.
   B) a unit of an electrical system, other than a conductor, that is intended to carry or control but not utilize electric energy.
   C) a unit of an electrical system from which current is taken to supply utilization equipment.
   D) None of the above statements (A-C) are true.

_____ The NEC defines a "**Raceway**" as:
   A) An oval track around which cars drive really fast.
   B) A type of conduit that is composed of either aluminum or steel.
   C) An enclosed channel that is designed for holding wires, cables or busbars.
   D) None of the above statements (A-C) are true.

_____ The "**Interrupting Rating**" of a Circuit Breaker (CB) defines:
   A) the maximum line current magnitude that the CB can safely interrupt
   B) the maximum line current magnitude that will cause the CB to trip
   C) the minimum line current magnitude that will cause the CB to trip
   D) the line current magnitude, above which, will cause the CB to trip instantaneously
   E) None of the above statements (A-D) are true.

_____ The NEC defines a "**Branch Circuit**" as:
   A) a circuit that taps off of a feeder circuit.
   B) the circuit conductors between the service equipment and the final overcurrent devices.
   C) a circuit that is protected by an overcurrent device.
   D) None of the above statements (A-C) are true.

_____ The **purpose of the NEC** is:
   A) the practical safeguarding of persons and property from hazards arising from the use of electricity.
   B) to educate electricians on the proper design and installation of an electrical distribution system.
   C) to provide a set of standards relating to the design of both industrial and bulk-power transmission and distribution systems.
   D) All of the above statements (A-C) are true
   E) None of the above statements (A-D) are true.

_____ An "**Circular Mil**" is best described as:
   A) a base unit of area equal to the area of a circle that has a 1millimeter diameter.
   B) a base unit of area equal to the area of a circle that has a $^1/_{1000}$ of an inch diameter.
   C) a base unit of area equal to the area of a square whose sides are 1millimeter in length.
   D) a base unit of area equal to the area of a square whose sides are $^1/_{1000}$ of an inch in length.
   E) None of the above statements (A-D) are true.

_____ A "**Disconnecting Means**" is best defined as:
   A) a device that allows a branch circuit to be disconnected from its load.
   B) a device that automatically disconnects a circuit from its source of power during overcurrent conditions.
   C) a device that automatically disconnects a circuit from its source of power during fault conditions.
   D) a device that allows circuit conductors to be arbitrarily disconnected from their source of power.
   **E)** None of the above statements (A-D) are true.

True/False Statements – Specify whether each of the following statements is "**TRUE**" or "**FALSE**":

_____ A stranded, #8 AWG, copper conductor will have the same **cross-sectional area** as a solid, #8 AWG, copper conductor.

_____ A stranded, #8 AWG, copper conductor will have the same **overall diameter** as a solid, #8 AWG, copper conductor.

_____ A stranded, #8 AWG, copper conductor will have the same (60°C) **ampacity** as a solid, #8 AWG, copper conductor.

_____ A stranded, #8 AWG, copper conductor will have a larger **cross-sectional area** compared to that of a stranded, #8 AWG, aluminum conductor.

_____ A stranded, #8 AWG, copper conductor will have a larger **overall diameter** compared to that of a stranded, #8 AWG, aluminum conductor.

_____ A stranded, #8 AWG, copper conductor will have a larger (60°C) **ampacity** compared to that of a stranded, #8 AWG, aluminum conductor.

Exam I pt. B

Instructions: Part "B" of this exam is a set of "take-home" problems that must be completed individually, under "closed-book" conditions, with no assistance from any person or resource except for the course PowerPoint slides.

Problem #9) Determine the minimum conductor sizes, the circuit breaker ratings, and the transformer's rating for the following 3Φ distribution network in order to properly serve the loads specified below.
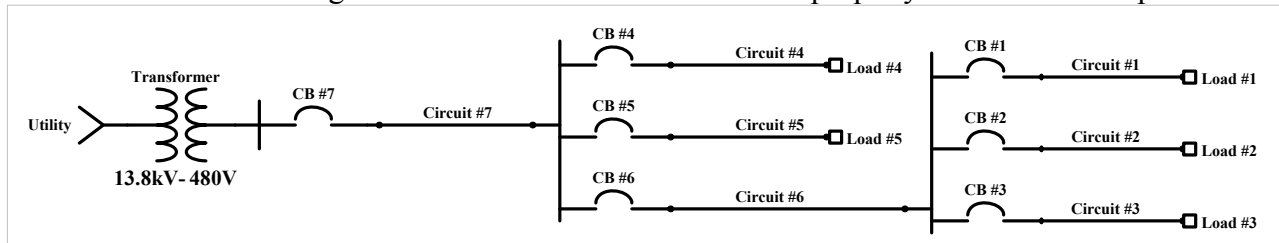

Load #	Load Requirements	
1	460V, 25kVA	(continuous load)
2	460V, 25kVA	
3	460V, 40kVA	(continuous load)
4	460V, 60kVA	(continuous load)
5	460V, 90kVA	

Note – when calculating load current, round the currents to the nearest "whole" amp.
– choose 3+1 individual, <u>THHN</u>, <u>copper</u> conductors for all circuits (instead of 3Φ cable), and assume all conductors will be fed through separately-run <u>aluminum conduit</u>.

Results: (**Show all work on blank paper stapled to the back of this exam booklet.**)

Circuit #1 – **conductor size** _____   **CB#1** – **rating** _____

Circuit #2 – **conductor size** _____   **CB#2** – **rating** _____

Circuit #3 – **conductor size** _____   **CB#3** – **rating** _____

Circuit #4 – **conductor size** _____   **CB#4** – **rating** _____

Circuit #5 – **conductor size** _____   **CB#5** – **rating** _____

Circuit #6 – **conductor size** _____   **CB#6** – **rating** _____

Circuit #7 – **conductor size** _____   **CB#7** – **rating** _____

Transformer #1 – 13,800V–480V   ratings _____ **kVA** _____**%Z**

Problem #10) Given the following diagram that shows a simple two-room dwelling unit;
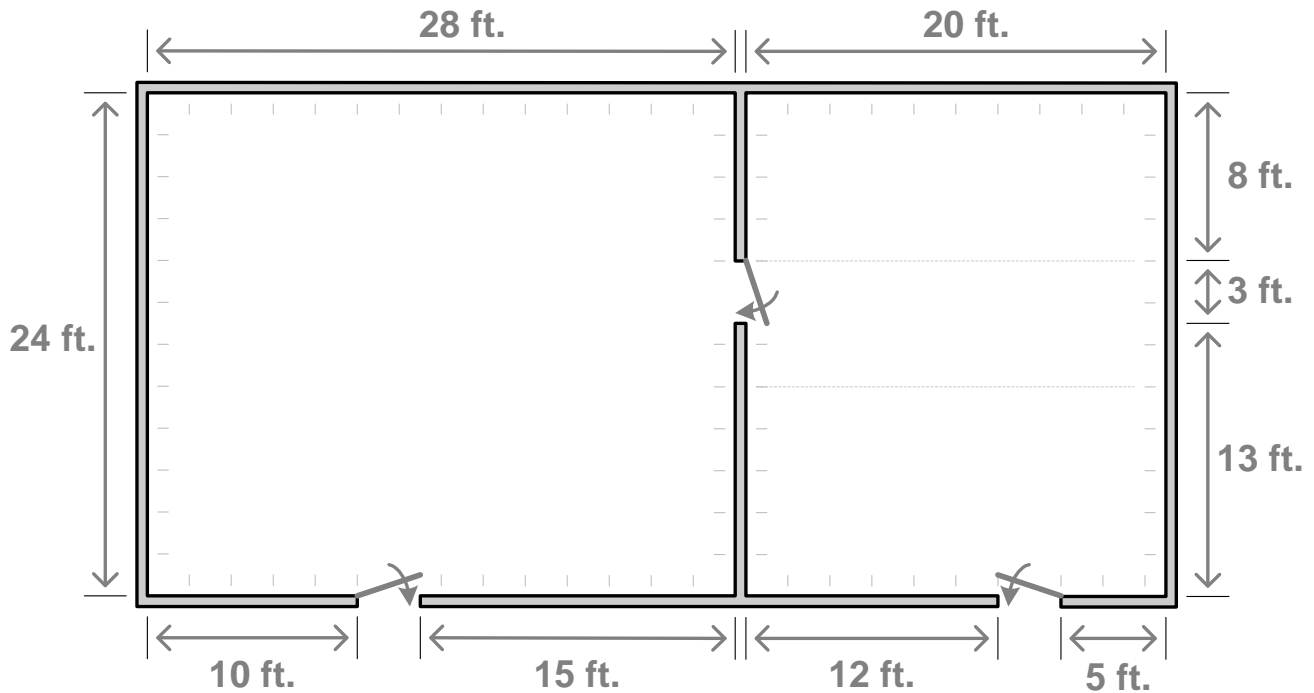
a) Based on NEC requirements, determine the **minimum number of receptacle outlets** that must be placed within the two rooms **and** accurately **show the location of the outlets** on the diagram. Note – the symbol for a receptacle is a ϕ.

min. # receptacles = _____

b) Although you decide to utilize 20A circuits to supply all of the receptacles, you also decide to limit the receptacle load on each circuit to a maximum of 9A. Based on NEC requirements, determine the **minimum number of circuits** that could be used to supply all of the receptacles in the two rooms if the minimum allowable load rating is assigned to each receptacle.

min. # circuits = _____

c) On the drawing above, identify the **location**(s) in each room that the **switches** for the lighting circuits should be placed by drawing a capital "S" at each switch location.

Do Not Write Below This Line

1) _____/6   2) _____/6   3) _____/10   4) _____/6   5) _____/4   6) _____/6   7) _____/4

8) _____/3   MC) _____/15   TF) _____/10   9) _____/18   10) _____/12   Total)_____/100